THE NEW

Self-Shifting Transmission

AS OPTIONAL EQUIPMENT

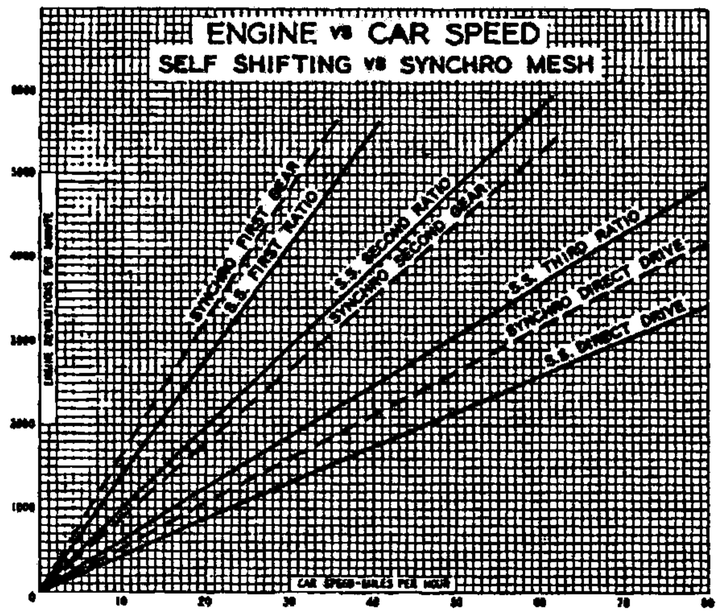
FOR THE 1938 SERIES 40

Buick

IS AVAILABLE ONLY AS ORIGINAL FACTORY INSTALLED EQUIPMENT AND CANNOT BE INSTALLED ON CARS PREVIOUSLY EQUIPPED WITH SYNCHRO MESH TRANSMISSION.

Advantages of Self-Shifting Transmission

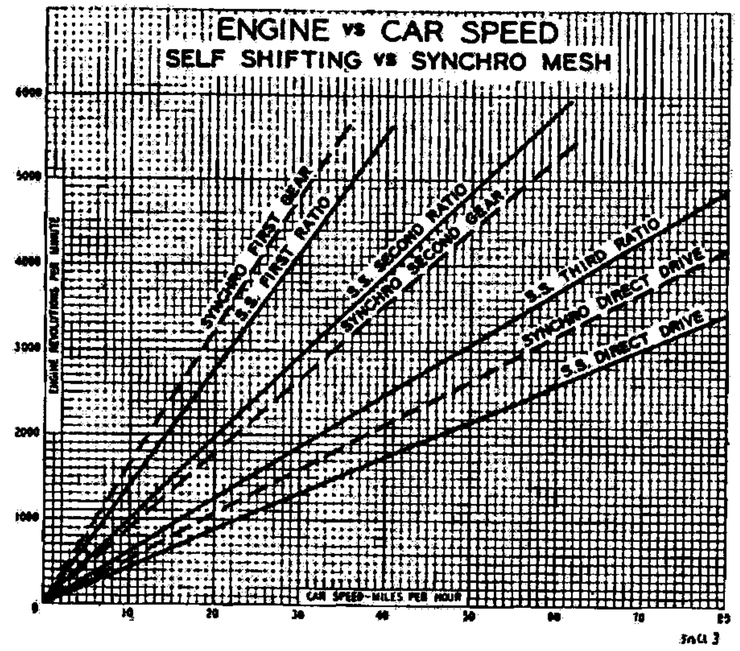
Automatic Gear Shifting.
Minimum Clutch Operation.
Greater Gasoline Economy.
Greater Oil Economy.
Improved Hill Performance.
Faster Acceleration.
Reduced Engine Speed.
Increased Flexibility at All Speeds.
Smoother, Quieter Engine Operation in Direct Drive.
Longer Engine Life.
Increased Convenience.
Elimination of Shifting Lever from Front Floor.



The "Low" Range of the transmission which includes a 1st and 2nd gear ratio, is primarily a power performance range, particularly adaptable for-

Starting the car in motion.
Rapid car acceleration.
Hill climbing.
Easier maneuvering in traffic.

If the control lever is moved to "Low" range from a standing start, first is automatically selected until 10 to 22 M. P H. is attained (according to throttle) when it automatically shifts to second speed without attention from the driver. It will automatically shift back at speeds below 8 M. P. H.



The "High" Range is primarily a cruising range and includes a 3rd and 4th (Direct) gear ratio. The 3rd and 4th gear ratios are so selected that the engine operates approximately 18% slower in 4th gear than the Synchro-mesh Transmission does in "High" gear, and 16% faster when in 3rd gear ratio.

4th Gear is a direct drive and the rear axle ratio is 18% lower than that in standard models.

Because of the resulting lowered engine speeds in 4th gear, a decided increase in gasoline and oil economy is effected, as well as quieter and smoother car performance.

Another particularly advantageous feature of the 4th gear operation is the fact that it will be utilized the greater part of the driving time, inasmuch as it will automatically be in operation above 22 m. p. h. , unless exceptional acceleration performance is required and the shift into third gear secured. Once 4th ratio is secured, transmission will stay in 4th down to approximately 16 m.p.h., part throttle.

Tests made in city traffic disclosed that the new transmission, even under these conditions, remained in Direct Drive for 95% of the accumulated mileage.

Reduced engine speed further manifests itself in the form of increased engine smoothness and quieter operation throughout the normal driving range.

At a car speed of 80 m. p. h. the engine in reality is operating at only 65 m.p.h or the crankshaft speed is but 3436 r. p. m. as compared with 4156 r. p. m. with the Synchro-Mesh Transmission

Not only is the speed of the engine reduced 18% but wear of the moving parts is reduced to an even greater proportion. This is illustrated by the well known fact that mileage covered at high engine speed is much more severe on all engine parts than this same mileage covered at a lower engine speed.

Other superiorities of the *Self-Shifting Transmission* are the greater accelerating and hill climbing ability it affords, the reduction in clutch operations, and the increased front seat passenger comfort it provides.

For example, with the car in 4th gear the driver has but to depress the accelerator to shift from 4th to 3rd gear, in which case the gear ratio at the rear wheels changes from 3.615 : 1 to 5.126 : 1. This feature is of considerable value when driving between 20 and 55 M. P. H in "High" Range inasmuch as the increase in accelerating performance means a decided increase in the margin of safety when passing cars on the highway.

Still greater acceleration can be obtained easily and quickly at low car speeds, by moving the Shift Lever to the "Low" Range Forward position.

Clutch pedal operation is considerably reduced. With the new transmission the clutch pedal is depressed and released only when the car is started from a standing start.

This large reduction in clutch operation adds to the pleasure of driving inasmuch as the car demands less attention from the driver, and materially lessens clutch wear.

The new transmission allows the front body compartment floor to be made free of any obstruction for its entire width, affording better sealing against dirt, noise, and drafts. The floor presents a more finished and tailored appearance.

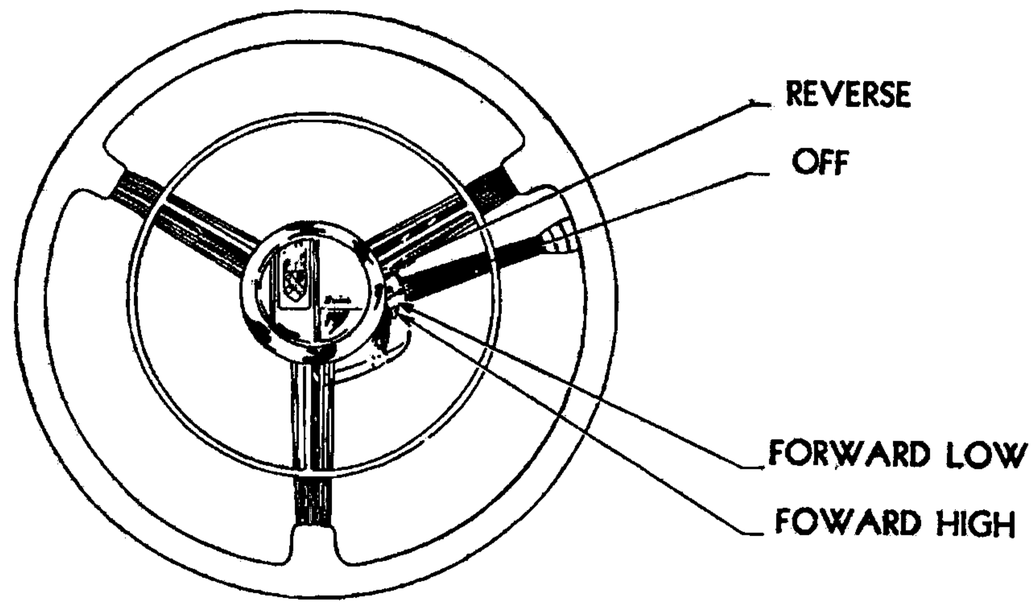
Further

with both -- gear shift and hand brake levers removed from the center of the floor, complete comfort is provided for three front seat passengers.

Operation of the car when equipped with the Self-Shifting Transmission

Before starting to describe how the shifting of the new Buick *Self-Shifting Transmission* is accomplished, it may be best to explain the gear ratios that are available and then explain how these gear ratios are obtained.

CONTROL LEVER POSITIONS

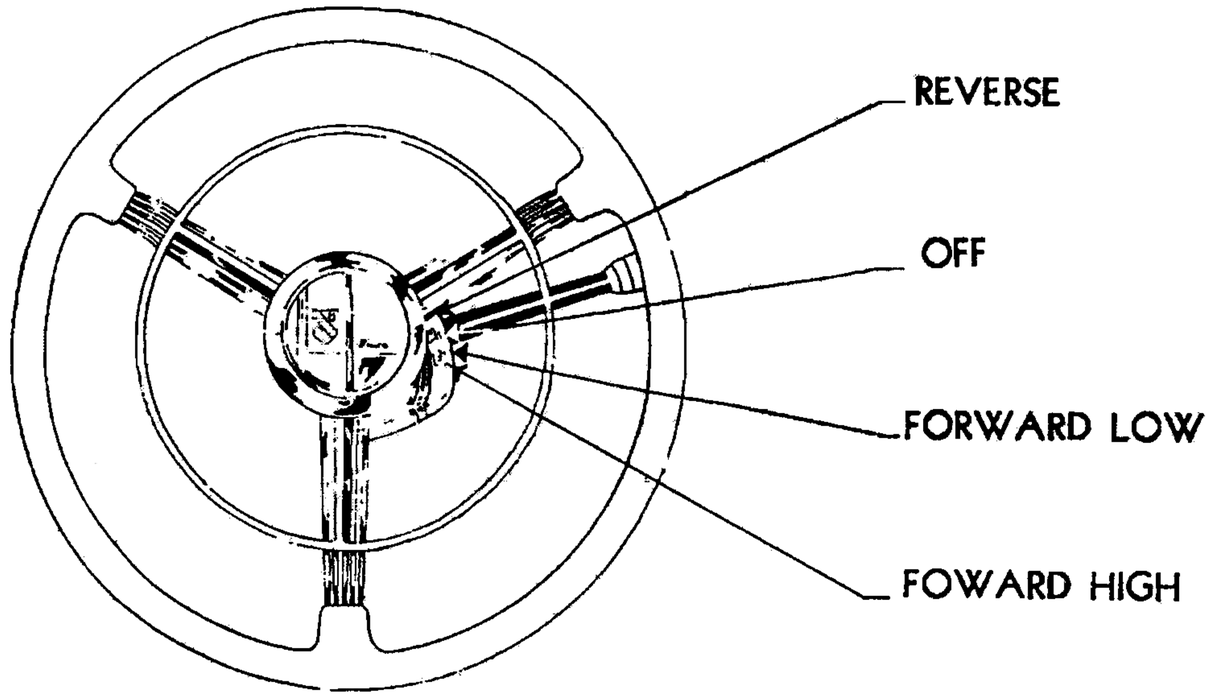


In the new transmission there are two forward speed ranges and one reverse gear.

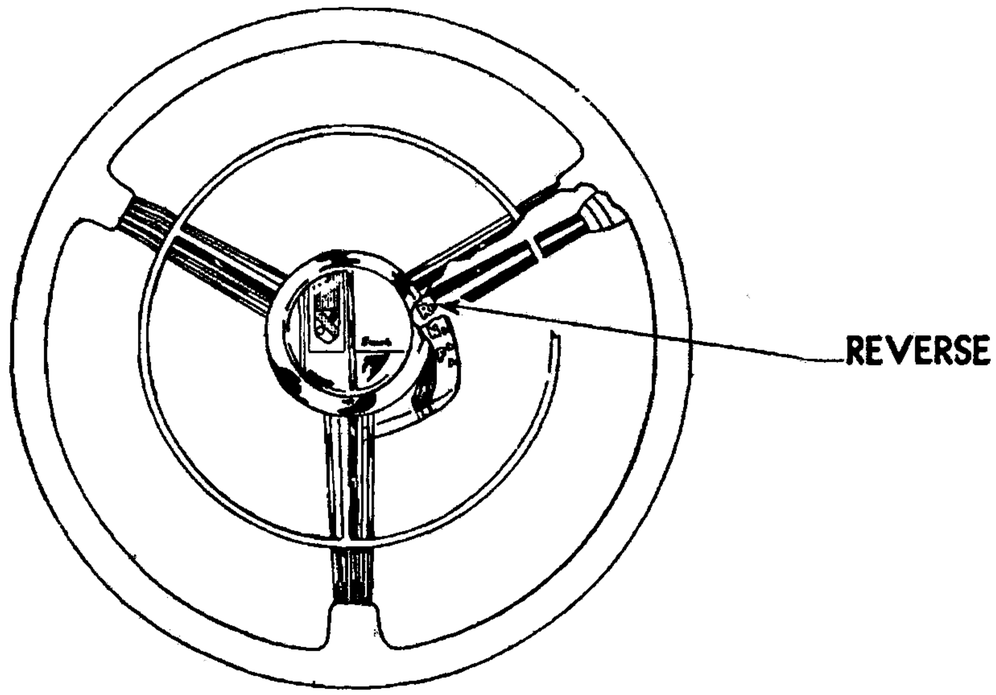
One forward speed range is known as the "Low" Range and the other as "High" Range. Within the "Low" Range the transmission will operate either in 1st or 2nd gear.

Within the "High" Range, the transmission will operate in either 1st, 3rd, or 4th gear. 4th gear permits a direct drive of the engine to the rear wheels.

The two ranges, then, provide three forward gear ratios and direct drive.

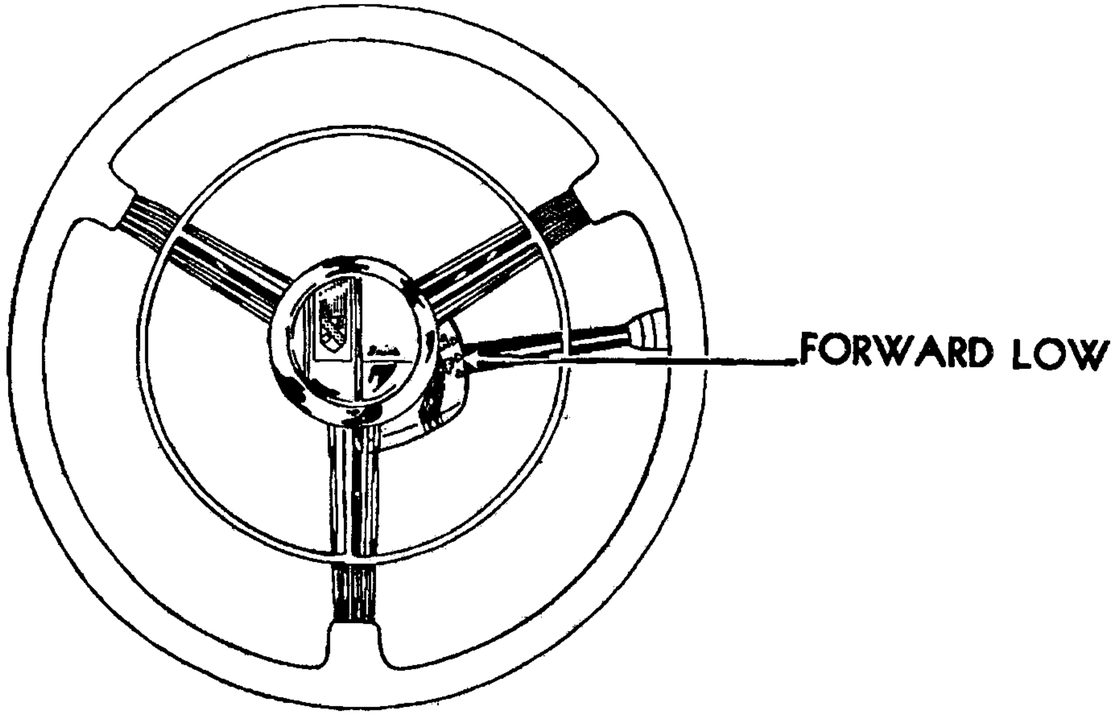


The shift from "Neutral" position to "Low" or "Reverse" is similar to the Synchro-Mesh Transmission in that a sliding gear must be made to engage manually with a clutch gear or a reverse idler gear. This is accomplished by means of a short shifting lever conveniently located immediately beneath the rim of the steering wheel. At the inner end of the shift lever is located a Shift Lever Box indicating the shift positions.



The shift lever can be moved to any position manually.

Before shifting from "Off" to "Rev" it is necessary to push inward on the spring loaded button at the outer end of the shift lever. The latch prevents the lever from being placed in "Rev" position unintentionally. The button should also be used when shifting from Forward "High" to Forward "Low".



To start the car in forward motion, the instructions are as follows:

1. Disengage the clutch.
2. Start the engine.
3. Move Shift Lever to "Forward Low" position.
4. Engage the clutch in the usual manner. The car will now move forward smoothly and in 1st gear.

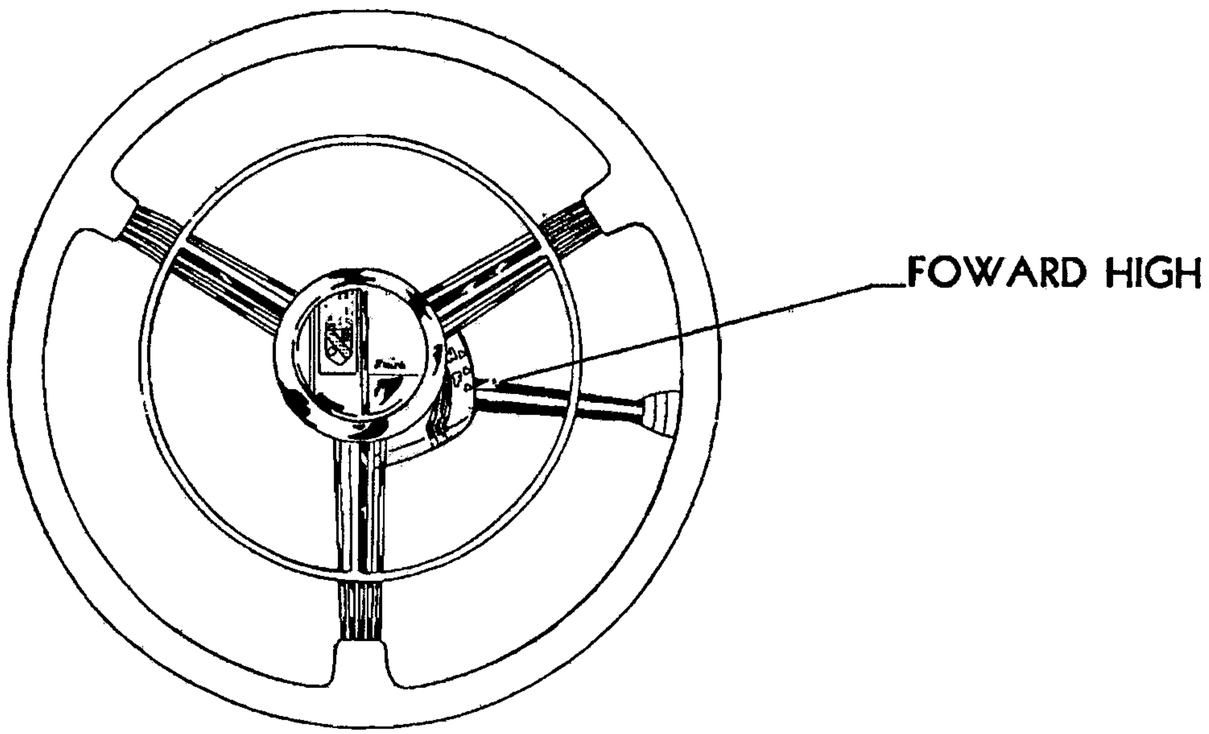
STARTING CAR

It is preferable that ALL starts should be made in "Low" Range position. It is essential:

--When the engine is cold

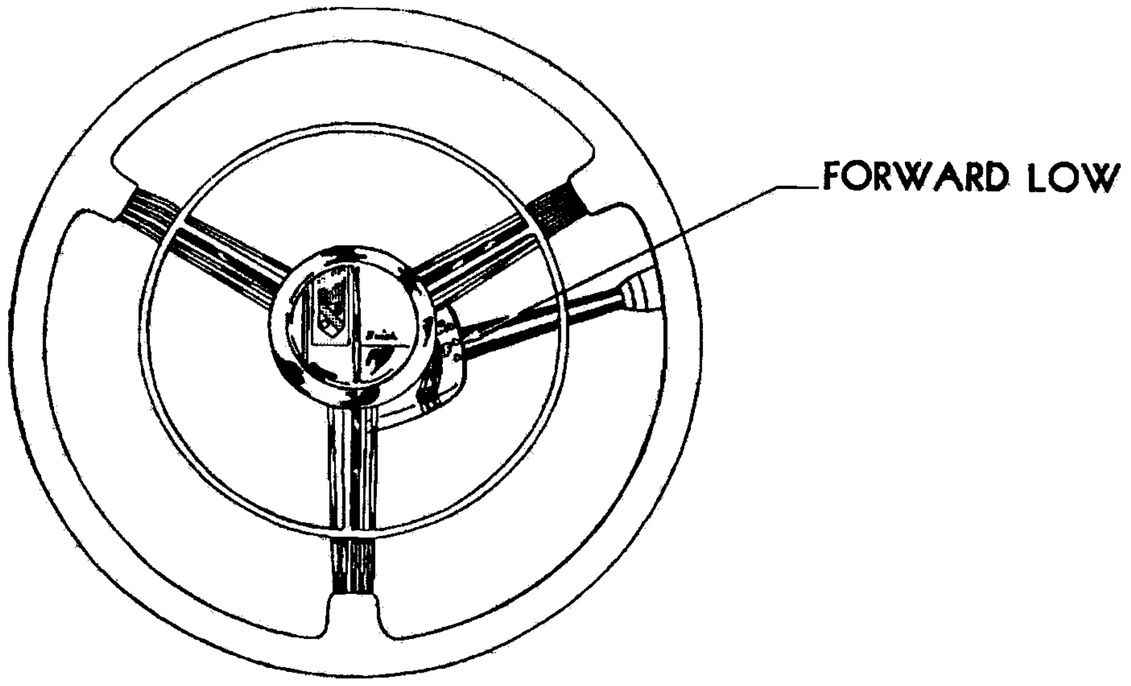
--When quick get away is desired

--When starting car on an upgrade



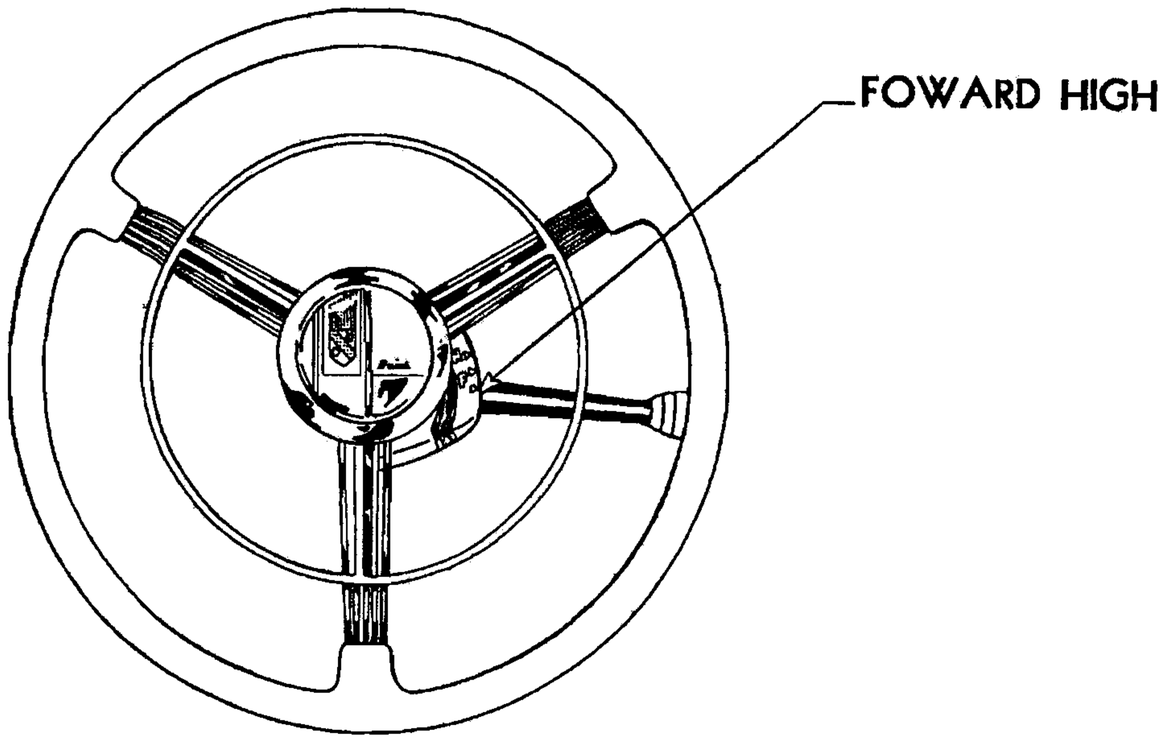
With the shift lever moved to "High" Range position, the car will start in 1st gear and shift automatically into 3rd gear at approximately 7 M.P.H. and then into 4th. gear depending on the accelerator pedal position.

However, starts in "High" should be avoided, as this causes excessive slippage in rear transmission clutch.



When the car is started in the Low Range position and the driver continues to accelerate at part throttle, the transmission will automatically shift from 1st to 2nd gear at about 10 M. P. H. If the throttle is opened wide, this upshift will occur at about 22 M.P.H.

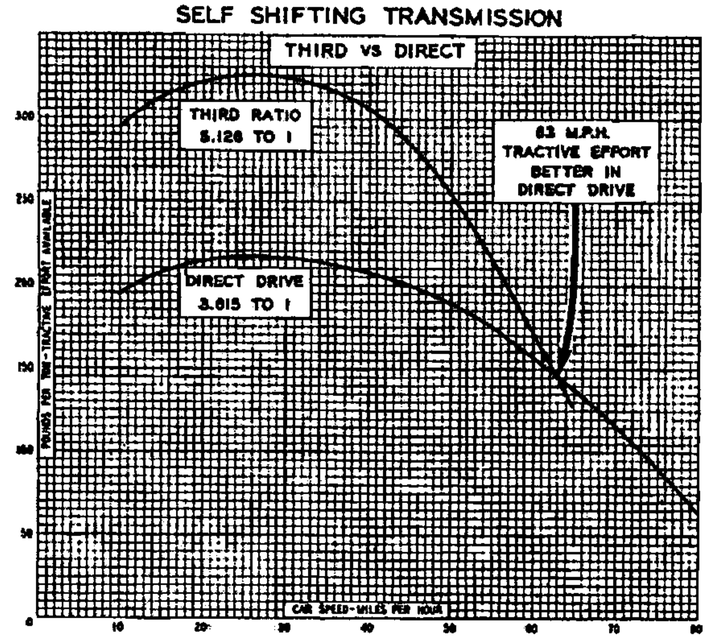
The car will continue to operate in 2nd gear unless the car speed drops below 8 M.P. H. in which case the transmisson will downshift into 1st gear again.



Now, to upshift from "Low" Range into "High" Range position, the shift lever need only be moved manually to this position. No disengagement of the clutch nor letting up on accelerator pedal is necessary in making this shift.

When the shift into "High" Range has been completed, the transmission is operated in either 3rd. or 4th. gear, - - - the controlling factor being the position of the accelerator pedal, and the car requirements.

After shift to 4th is completed (at 22 m.p.h. part throttle) the car will operate in direct drive down to 16 m.p.h. unless accelerator pedal is depressed to the wide open position.



If in 4th gear and quick acceleration is desired, the Foot accelerator should be fully depressed. This procedure shifts the transmission into 3rd. gear. The pedal position at which the shift occurs can be readily identified by the driver by an increased resistance in the accelerator pedal travel lasting for an instant only.

At approximately 63 M. P. H. the transmission is automatically locked into 4th. gear, regardless of the position of the accelerator pedal. Above this speed a shift into 3rd. would be undesirable because the accelerating performance of 4th gear at speeds above 63 M.P.H. is greater than 3rd gear performance.

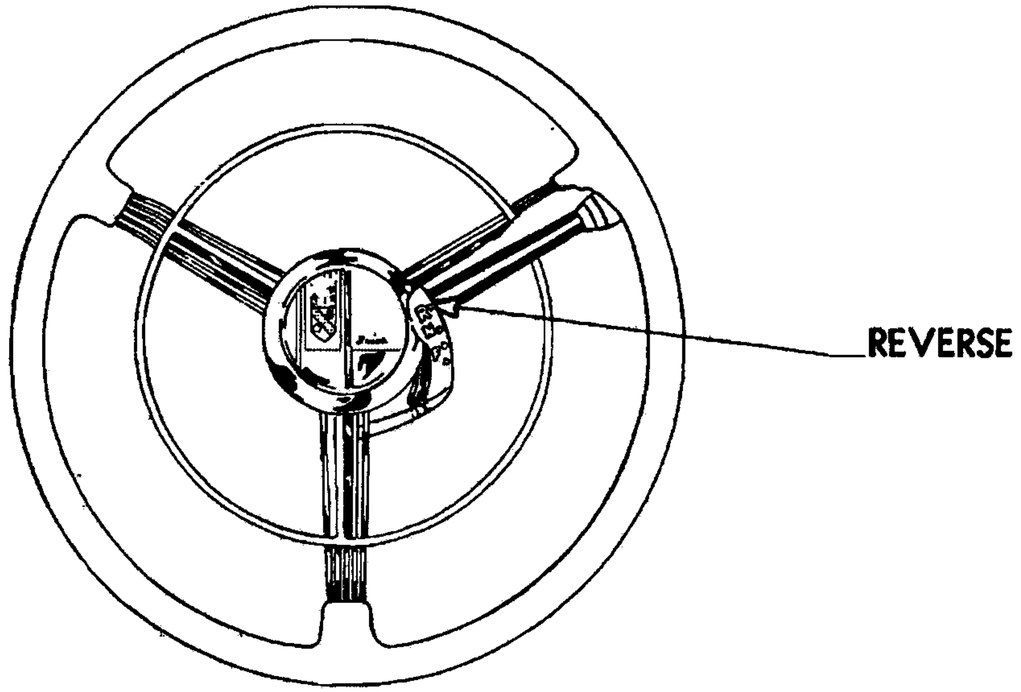
To shift from "HIGH" to "LOW" range, car moving.

This shift is made by manually moving the Shift Lever from "HIGH" to "LOW" range position without disengaging clutch.

This shift presents a means of obtaining additional braking effort from the engine when descending long steep grades, and is comparable to shifting from 3rd to 2nd gear in the conventional transmission.

Increase in car speed up to 35 M.P.H. when ascending grades can also be had thru this shift. While the shift can be made at any throttle position, more pleasing shifts result if the accelerator pedal is momentarily released at the time of the shift. This procedure prevents excessive slipping of the transmission clutch.

Shifts from "HIGH" to "LOW" range in slow moving congested traffic can be made at any throttle position and without disengagement of the clutch.



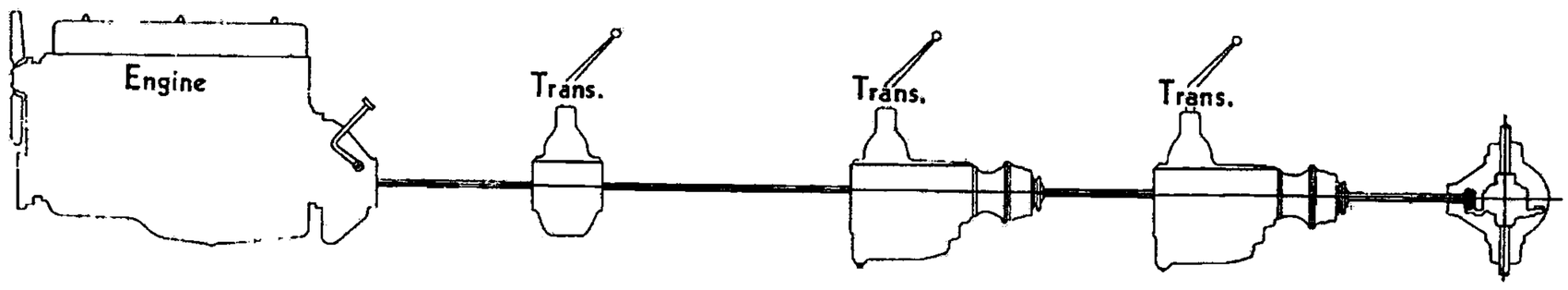
To reverse the direction of the car, the following shifting procedure should be followed:

1. Disengage clutch and start engine.
2. Depress button at outer end of shift lever and then move lever to "R" position.
3. Engage clutch pedal and the car will move in reverse direction.

UNITS
COMPRISING
the
Self-Shifting Transmission
and
THEIR FUNCTION

Suppose we had

3 transmissions



Reverse Gear Neutral Forward

Direct 1.418-1 Reduction

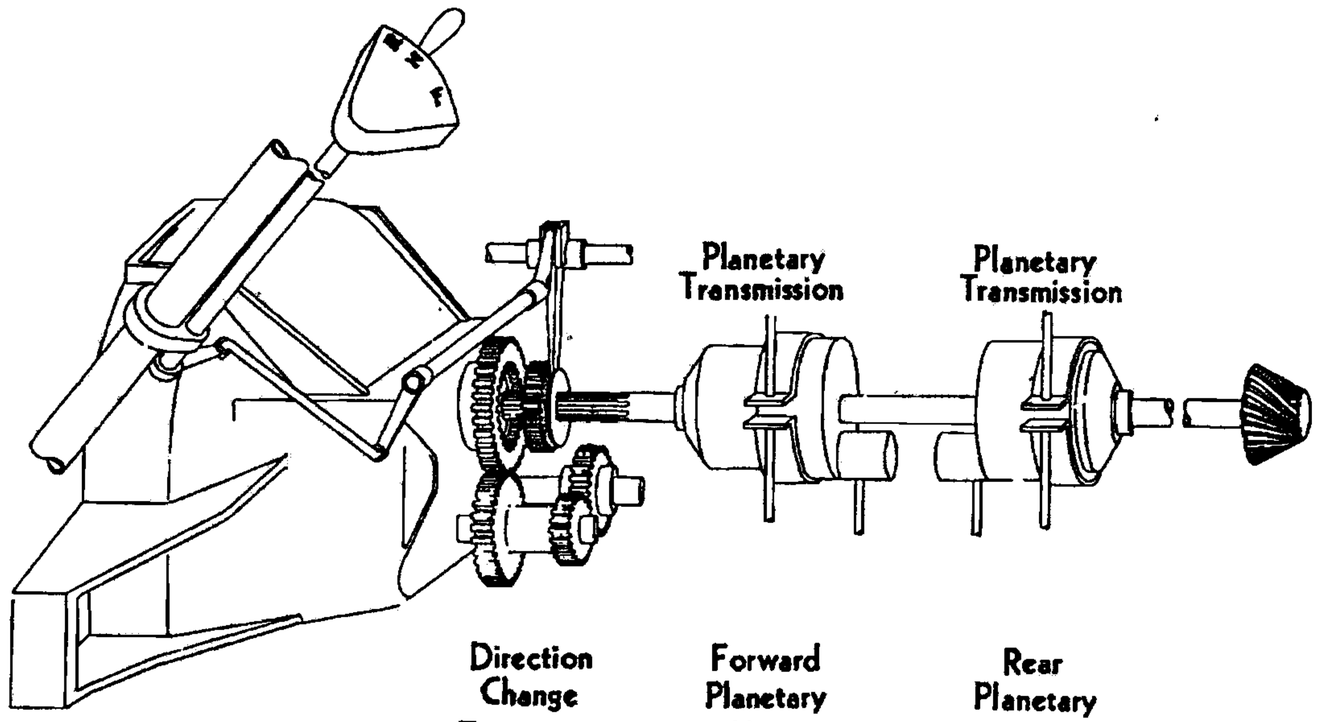
Direct 2.228-1 Reduction

High Axle Ratio 3.615 to 1

3.159-1 Combined Reduction

These would give operator 4 different forward speeds, as follows:

			Trans.	Wheels
1st.	1.418	2.228	3.159	11.423
2nd.	Direct	2.228	2.228	8.054
3rd.	1.418	Direct	1.418	5.126
4th.	Direct	Direct	1.	3.615

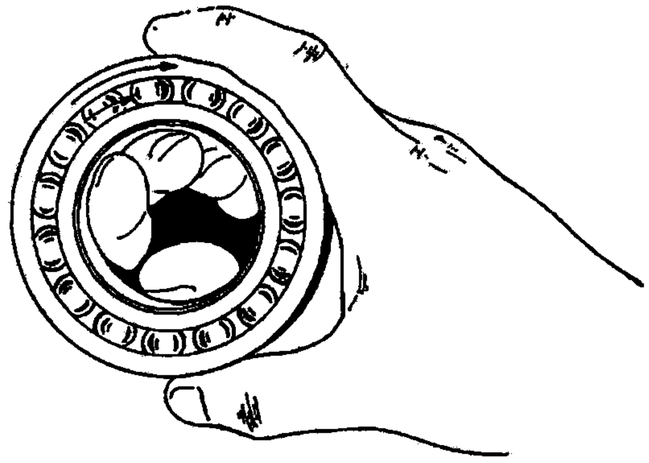


Direction Change Transmission known as Head set Direct or Neutral or Reverse	Forward Planetary Unit Direct or 1.418	Rear Planetary Unit Direct or 2.228

Here we have what amounts to the same idea-

We all know how direction change and neutral is accomplished in a Synchro-Mesh Transmission. This arrangement is provided in the head set of the *Self-Shifting Transmission* and requires no explanation. The clutch should be disengaged for reverse, first or when returning to neutral.

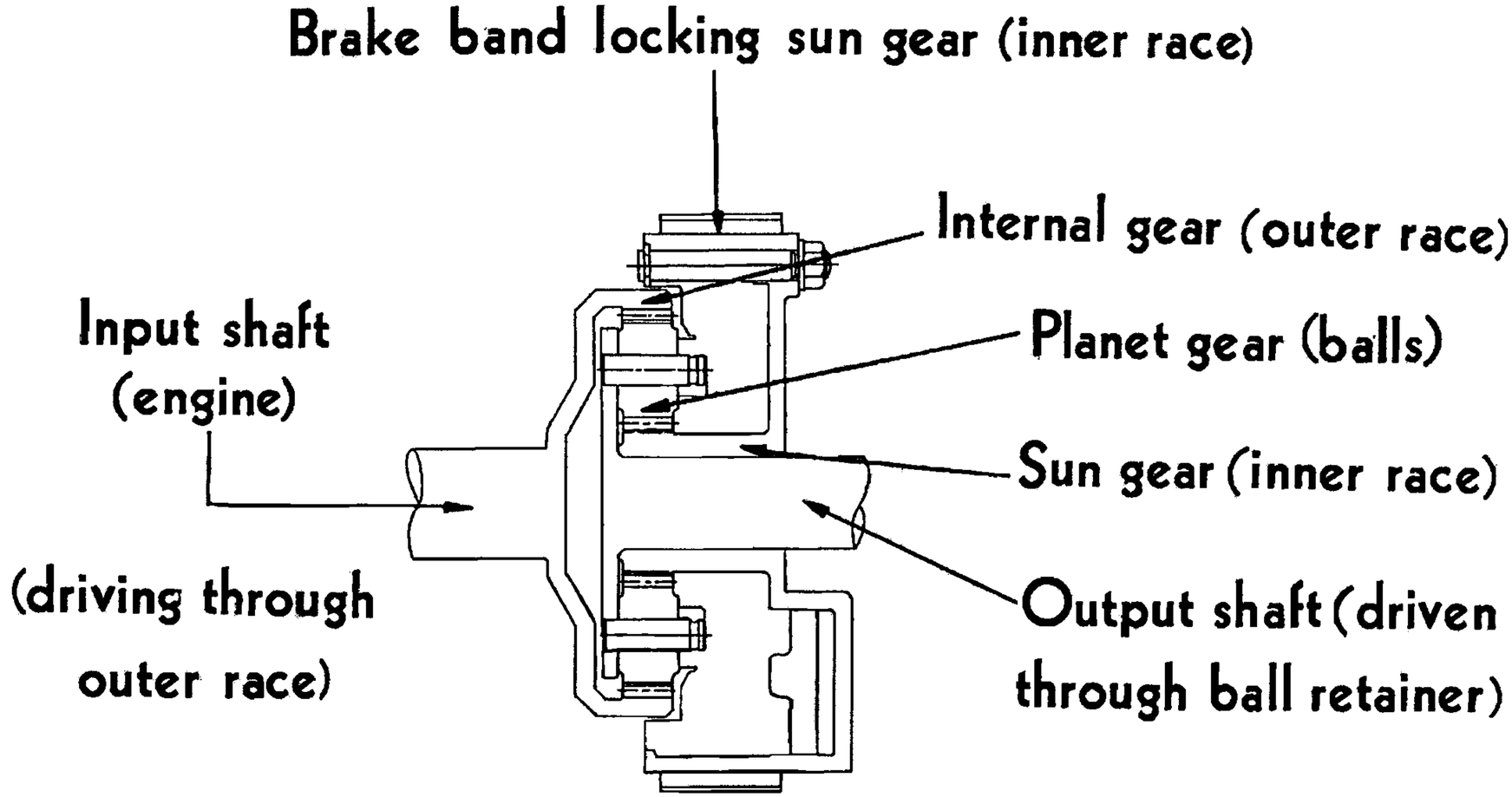
For those unfamiliar with the planetary type of gear reduction, or transmission, a ball bearing can be used to illustrate the principle involved.



If the inner race is held stationary and outer ball race revolved, then ball bearing retainer will revolve at a reduced speed.

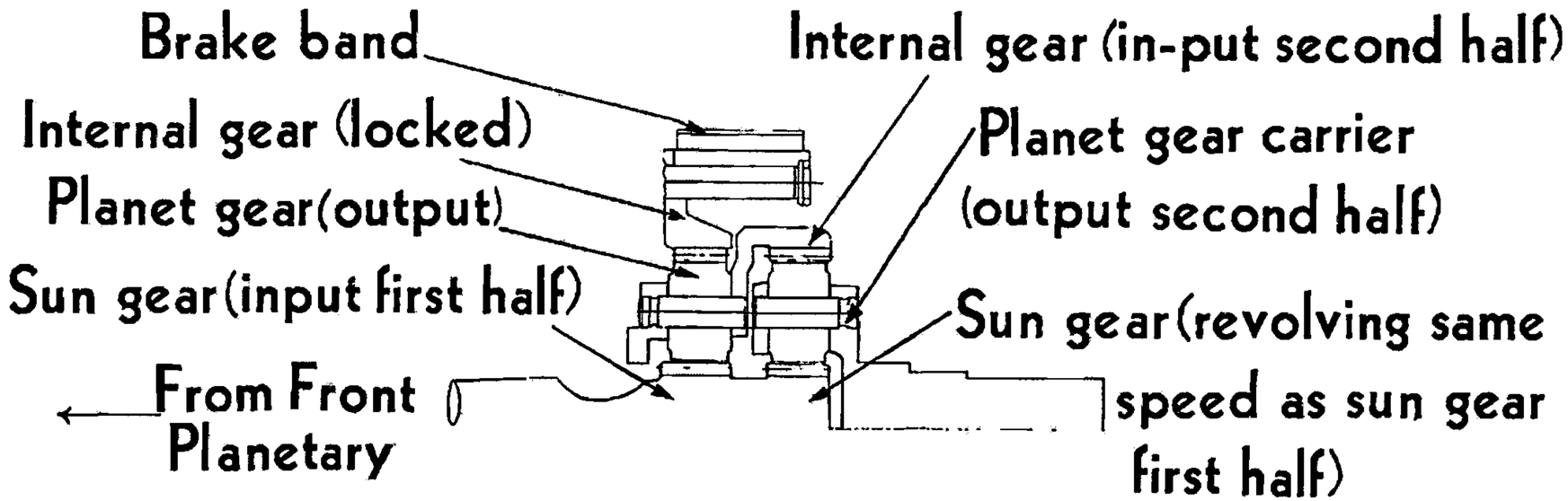
If we then take a power output from the ball retainer, the bearing becomes in effect a planetary transmission.

Very little power could be transmitted through balls because of slippage, therefore gear teeth are used.
Here we have a conventional planetary transmission.



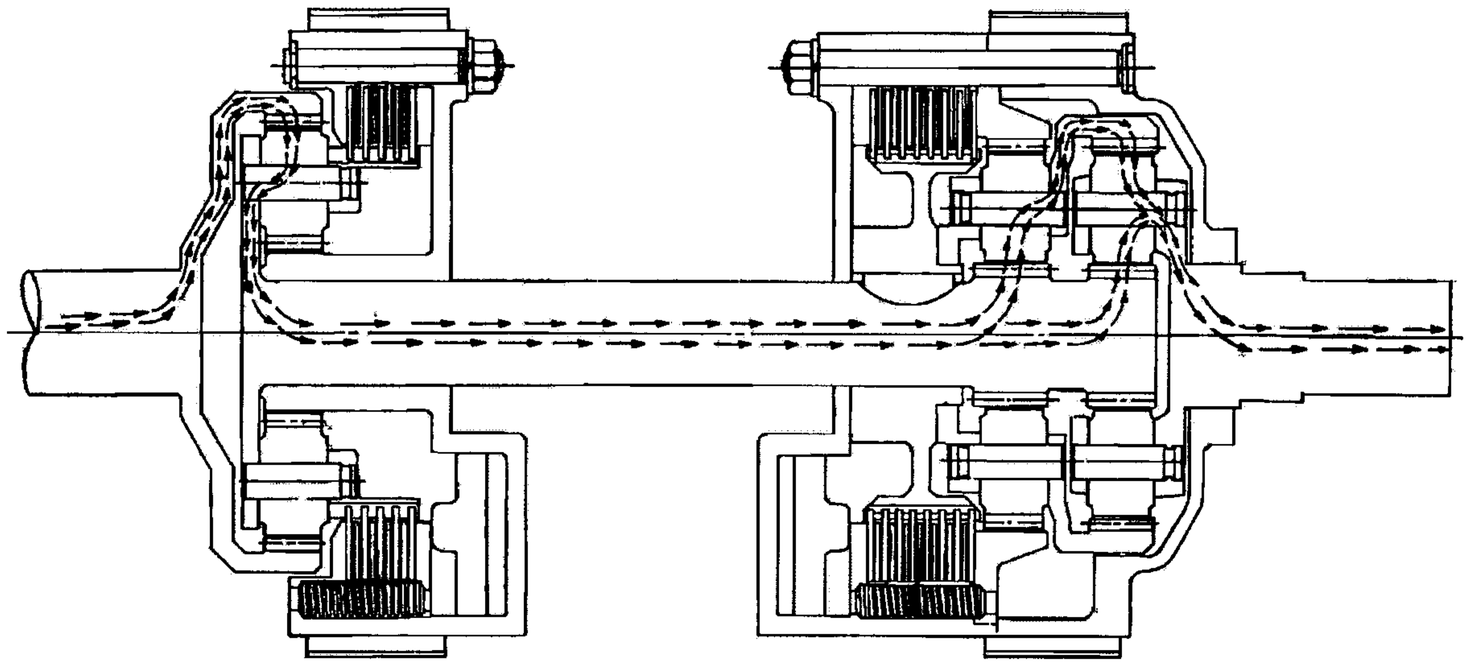
and we have the equivalent of the Front Planetary transmission with a gear reduction of 1.418 to 1.

The rear planetary unit gives a reduction of 2.228 to 1. To make a single unit of ample strength would require gears too large to fit the available space, consequently a double unit is used.



The input is through sun gear with the internal gear locked by a brake band in first half of this unit. This gives a reduction of 3.88 at planet gear carrier which is a greater reduction than desired so this is stepped up in the second half, enough to give a reduction of 2.228. This is accomplished by coupling output of first half to the internal gear of second half, at the same time sun gear is driven by the sun gear of first half, taking output from the planet gear carrier.

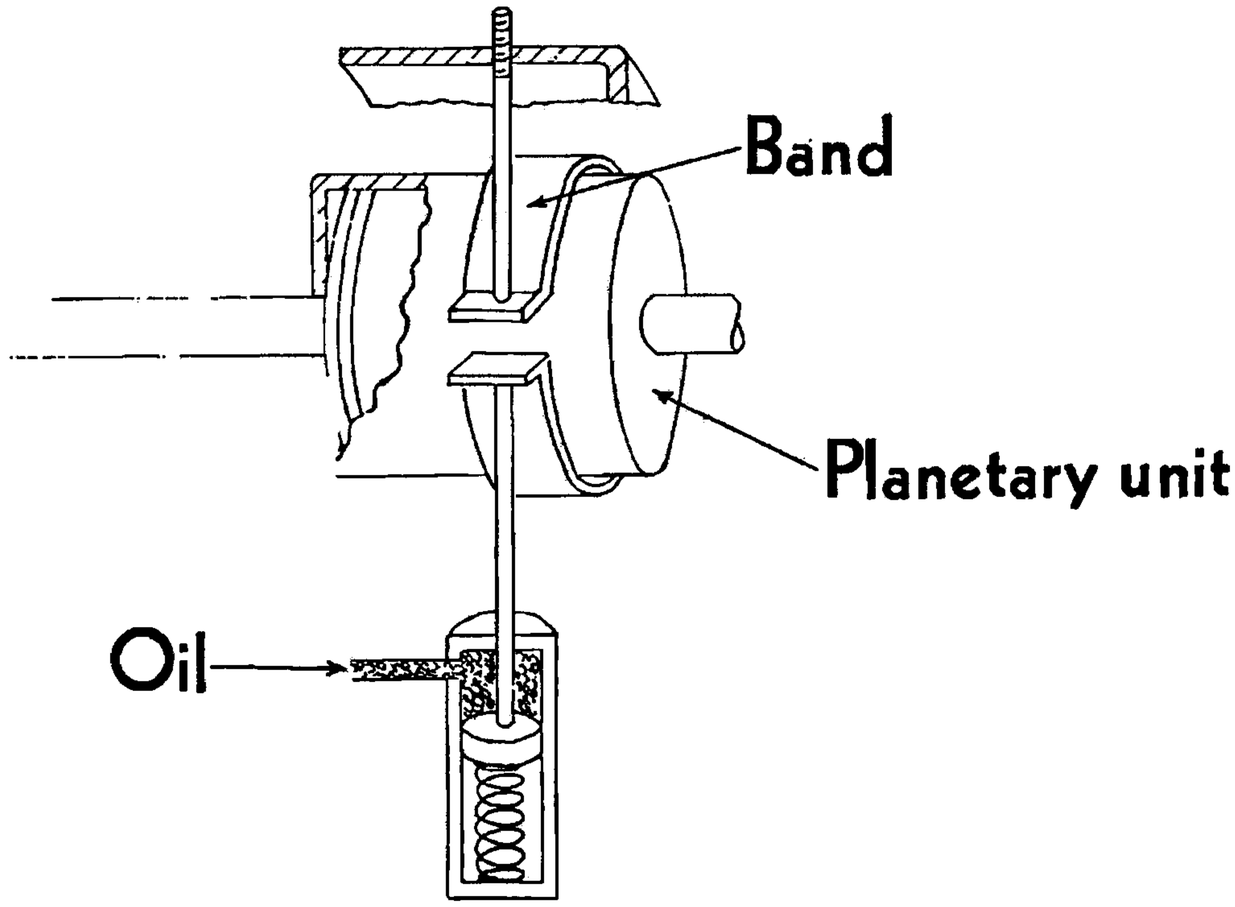
At this point let us review and be sure we understand the flow



of power through front and rear planetary units when these are functioning as reduction gears in low gear. (Brake bands are applied to both units.)

Note: All gears in this transmission are helical gears.

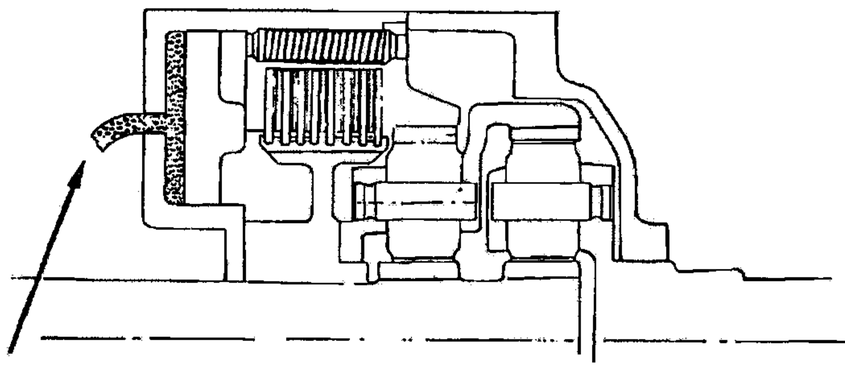
Coil springs behind both servo unit pistons act to tighten the brake bands, which prevent rotation of planetary units.



When oil under pressure is directed to the opposite side of servo pistons, they are forced back and release the brake bands.

To obtain a direct drive through each planetary, a clutch is used.

A set of clutch plates lock planet gear carriers to the internal gear, making the entire planetary one solid unit.

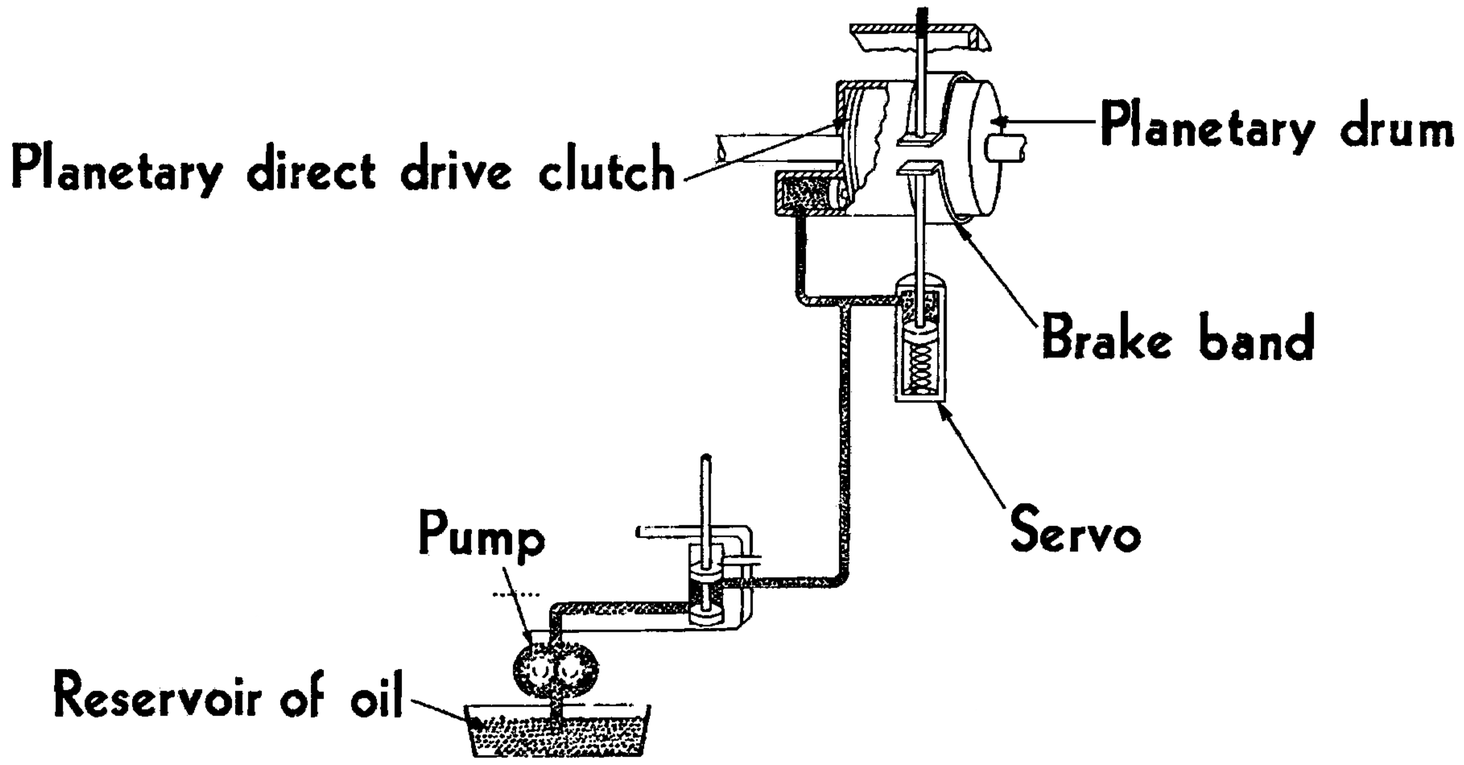


Oil under pressure compresses clutch plates.

The clutch is engaged by a hydraulic piston.

The rear planetary unit is shown, but front unit also has a clutch

If we now couple the oil pipe from clutch piston to the pipe from servo unit piston and supply pressure from a conventional gear



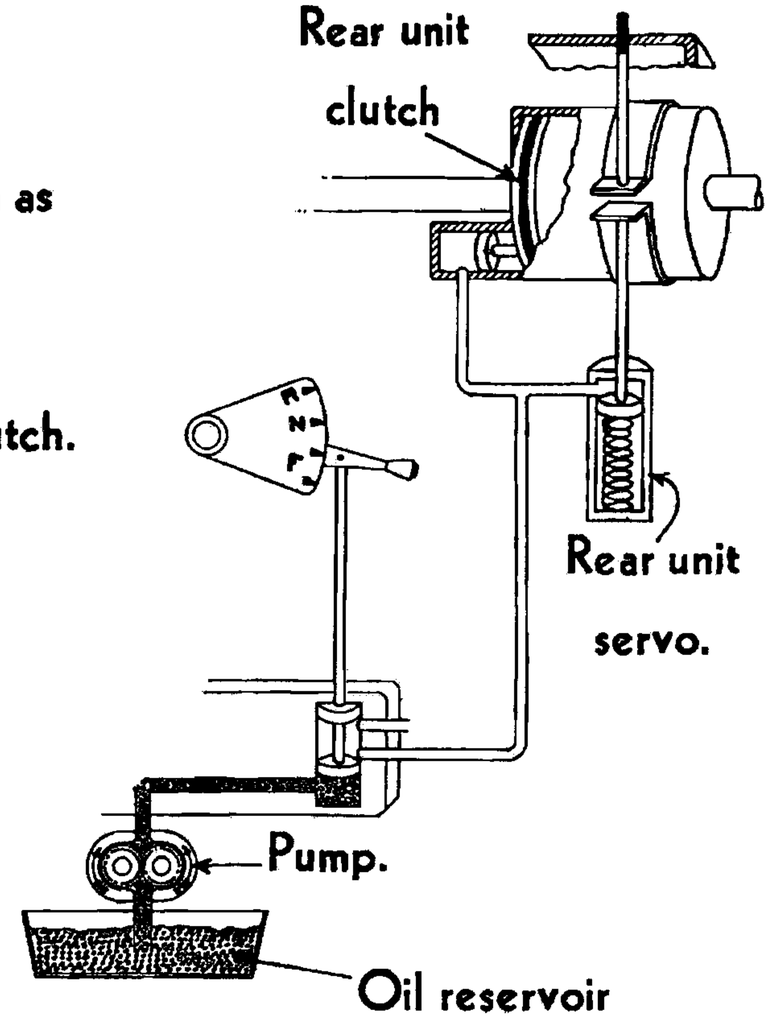
pump, then the same hydraulic pressure will at the same time release brake band and apply the clutch.

The amount of overlap before the band releases and the planetary clutch releases are dependent on several factors which will be explained later.

A manually controlled valve is used to direct the oil under pressure to the servo and clutch of the rear planetary unit.

With control lever in low range position as shown there is no oil pressure to the rear unit servo or clutch.

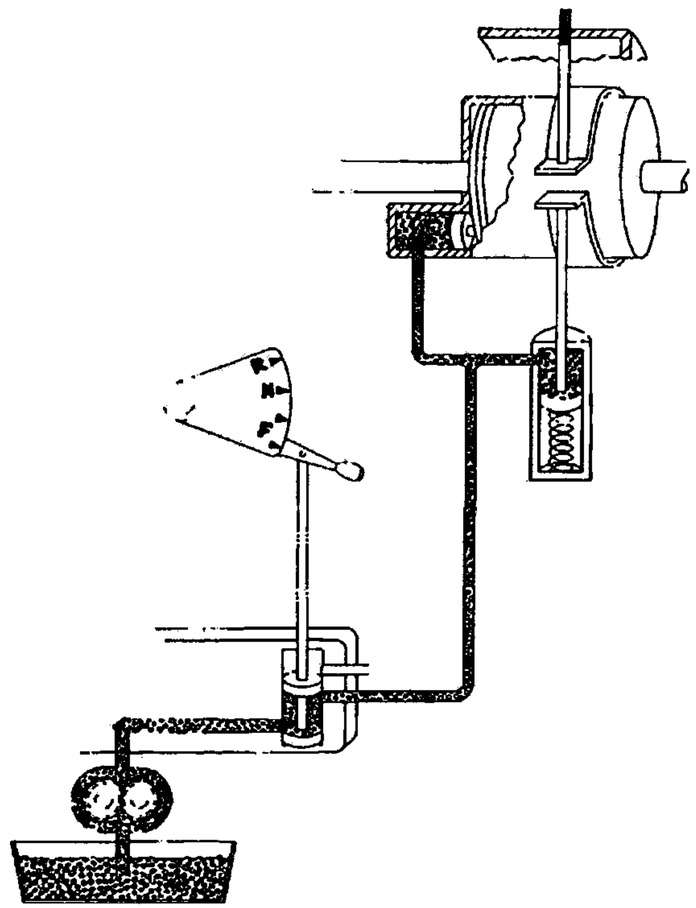
This allows the rear planetary to operate with a reduction of 2.228 to 1



A manually controlled valve is attached to the control lever on the steering post.

This gives the required movement of the valve to change from low to high range.

With control lever moved to High Range position as shown

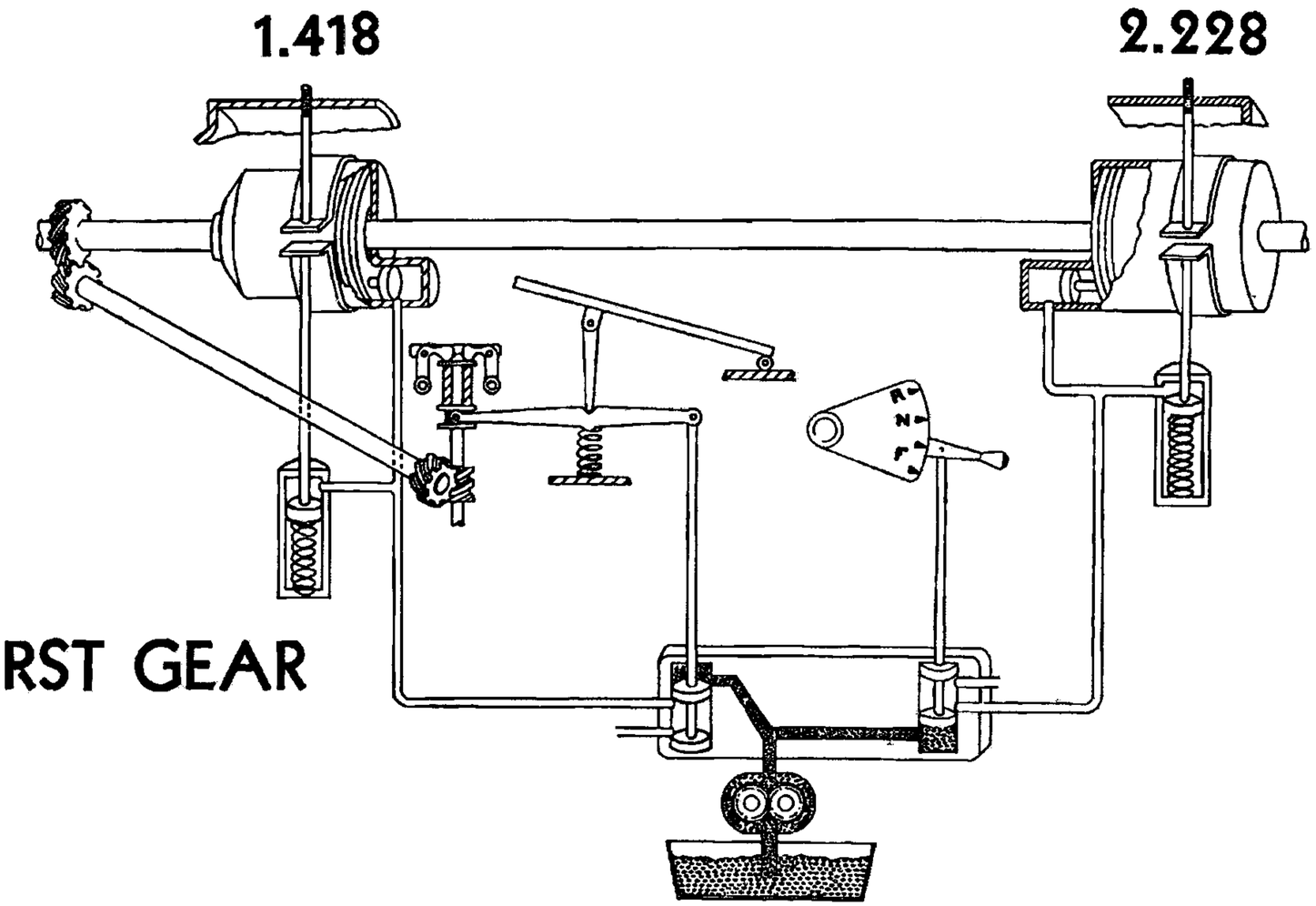


Oil pressure is applied ahead of rear servo piston, compressing the spring and releasing band. At the same time oil pressure is applied behind the clutch piston, locking planetary set and causing it to rotate as a unit with no reduction.

Two sets of planetary gears in the Rear Planetary Unit rather than one set as in Front Planetary Unit results in higher speed reduction through Rear Planetary Unit.

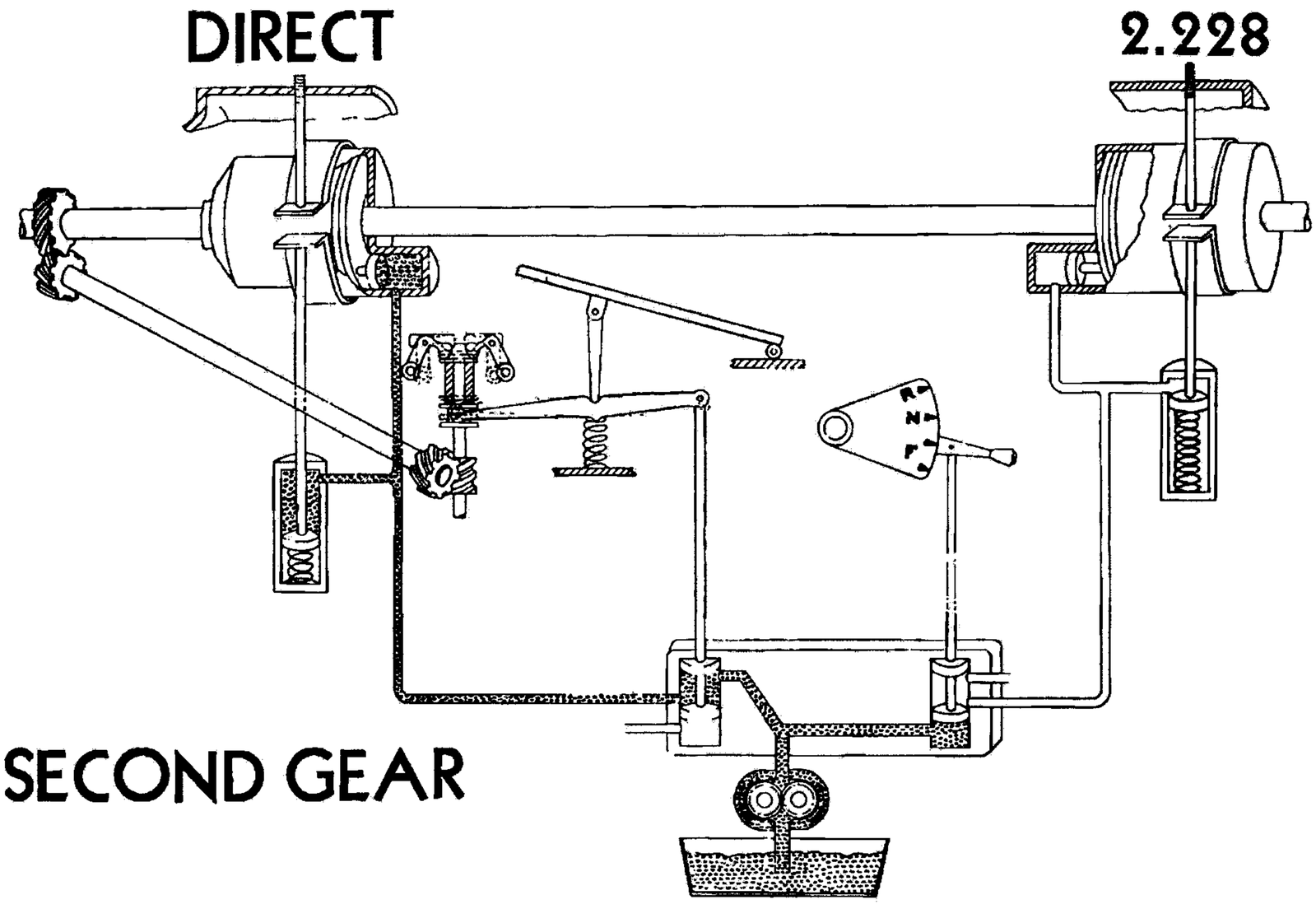
The larger Rear Unit contains 8 bronze and 7 steel clutch plates as compared to 5 bronze and 4 steel clutch plates in the smaller Front Unit. The servo spring pressures of the Rear Unit also are considerably higher than those of Front Unit.

The remaining parts of the Rear Planetary are similar to Front Unit with the purpose and operation of each part identical.



FIRST GEAR

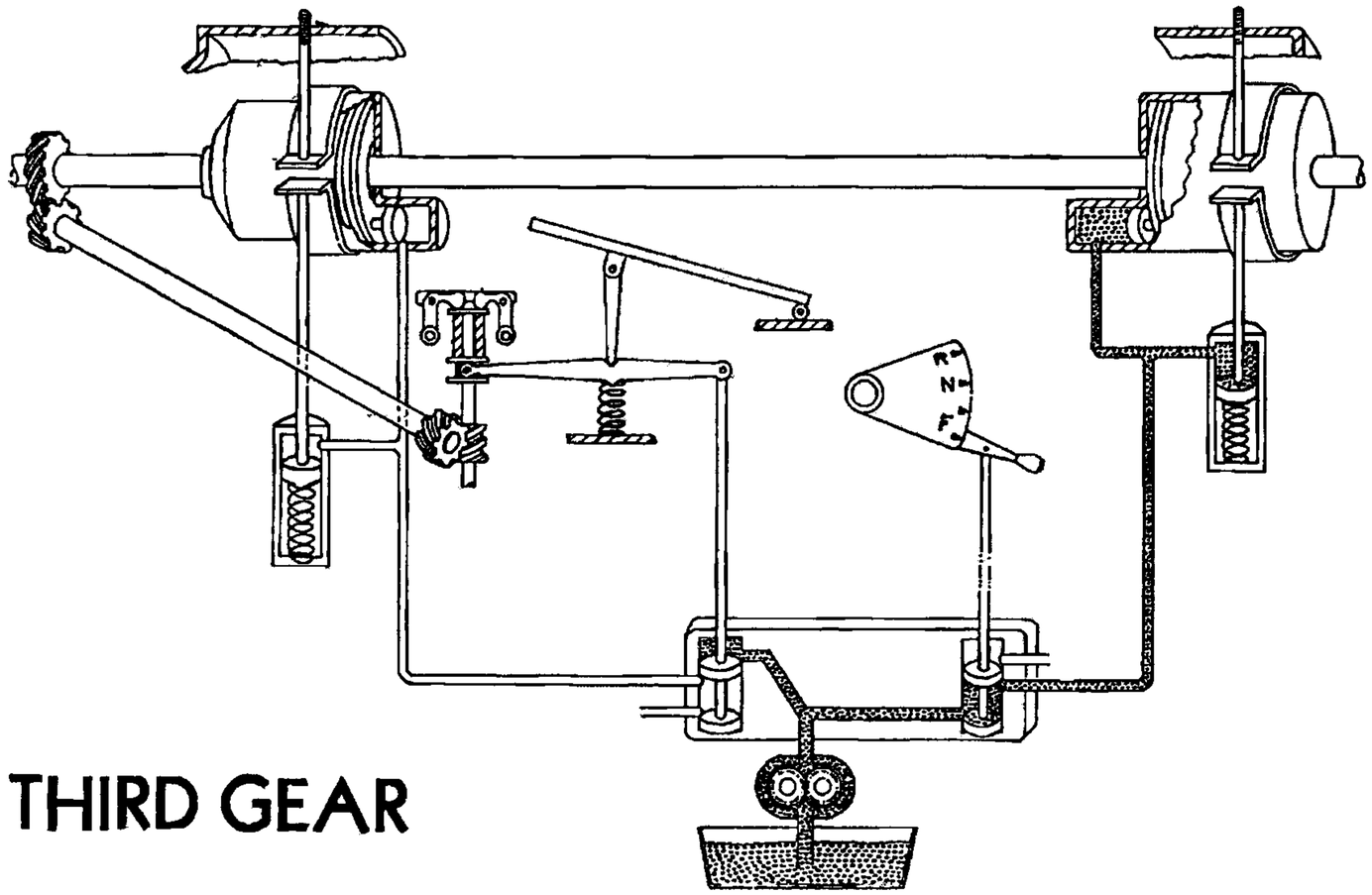
Let us note, with all possible reduction through transmission, or in other words first gear, both planetary gear sets are working as reduction units - 3.159:1



In second gear the rear unit continues to function as a reduction unit in a ratio of 2.228: but the front unit provides merely a direct coupling from clutch gear to the rear unit.

1.418

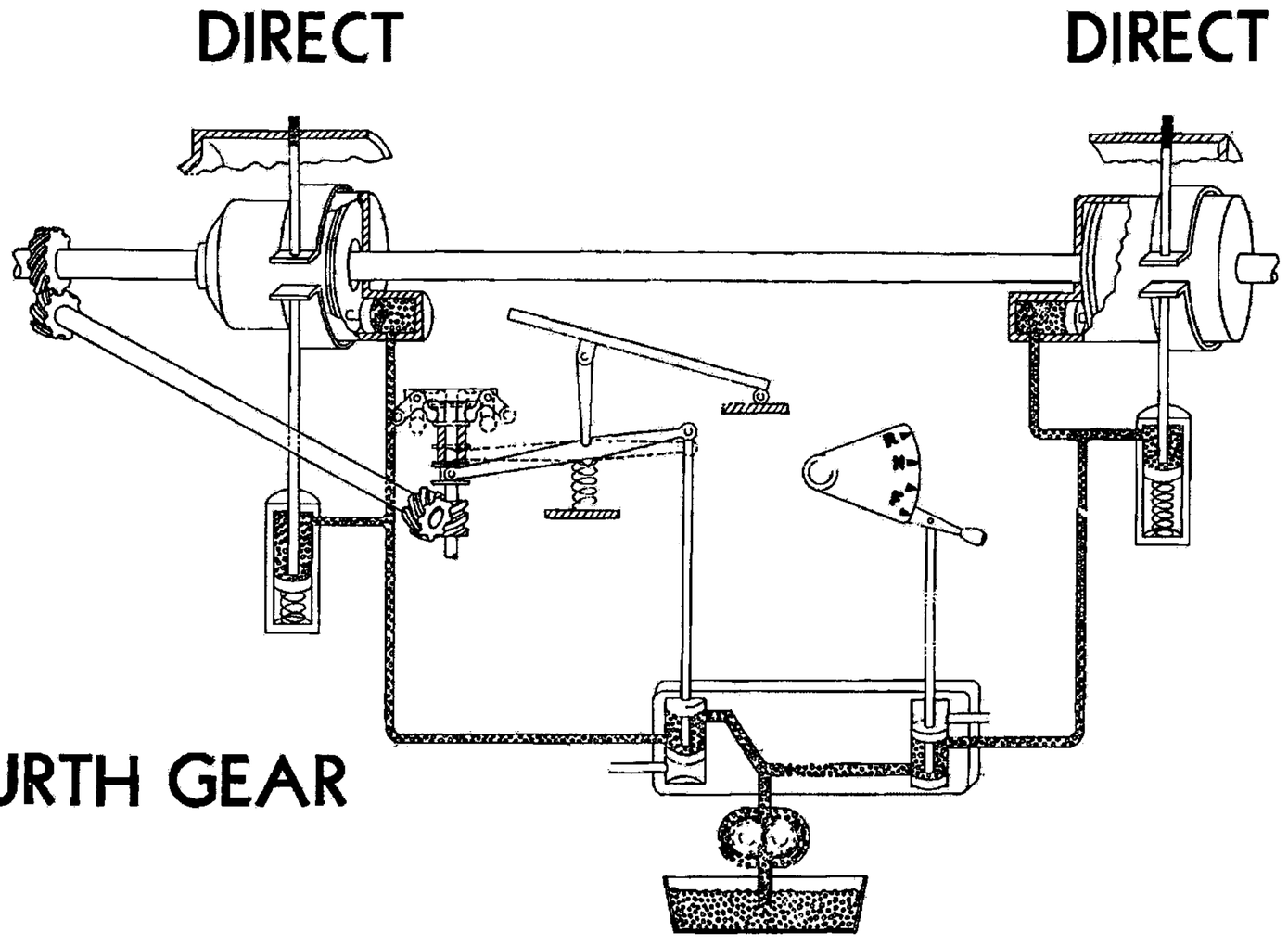
DIRECT



THIRD GEAR

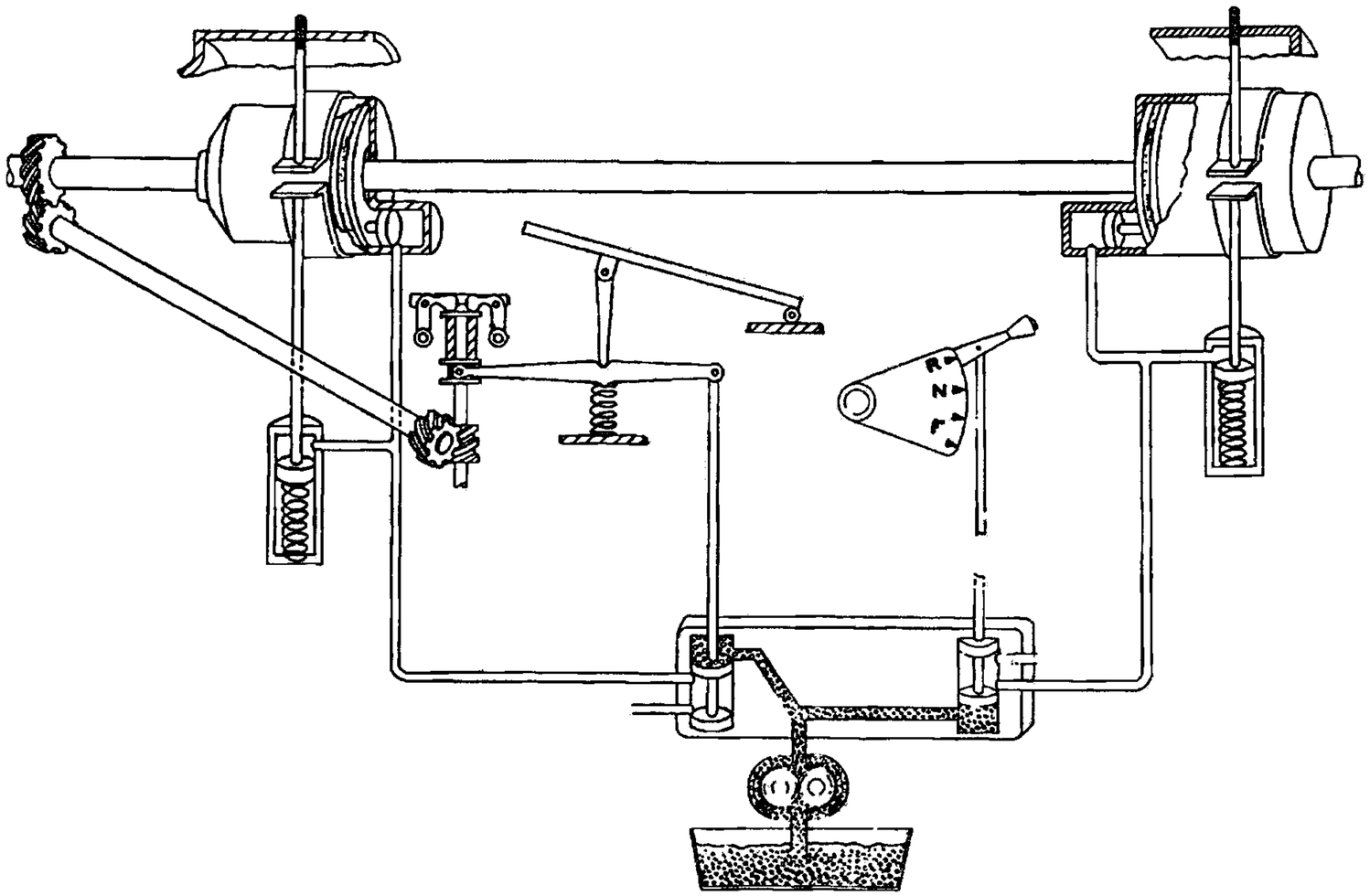
In third gear the front unit again becomes a speed reducer in the ratio of 1.418:1 and the rear unit is a Direct Drive between front unit and propeller shaft

Showing governor distended and both planetary units in 4th speed.



FOURTH GEAR

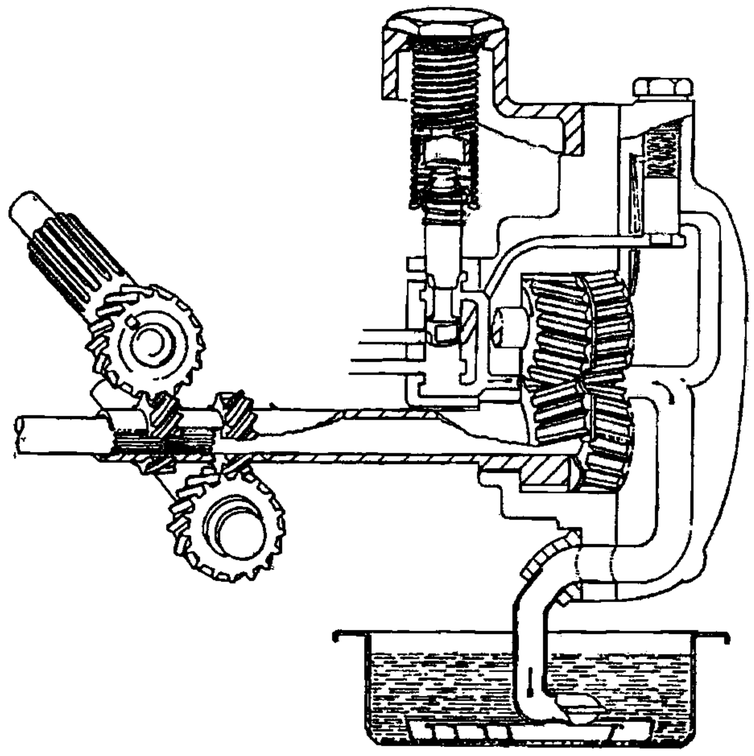
In 4th gear both planetary units provide only a direct coupling.



In the case of reverse gear, planetary units function as for Low gear but the reverse gear train between car clutch and driving stem of the front unit is also engaged.

A gear type oil pump is used to provide oil under pressure for operating planetary clutches and servos, also for pressure lubrication.

This is actually two oil pumps with two drive and two driven gears. The larger drive and driven gear operate through worm gears off the countershaft and are, therefore, operating any time the engine is operating and the engine clutch engaged.



The smaller drive and driven gear operate off a worm gear on stem of front unit and therefore operates only when rear wheels turn.

With the transmission in Neutral position, and the engine operating with clutch engaged, the larger oil pump gears only are rotating and producing oil pressure in order to provide lubrication to the various transmission parts.

When engine is not operating and the car being towed with Shift Lever in "OFF" position, only the small gears in the pump operate, as mentioned earlier.

NOTE:

It is important when towing, with the engine not operating, to have Shift Lever in "OFF" position. If this is not done, it will be equivalent of towing a car with Synchro-Mesh Transmission in low gear.

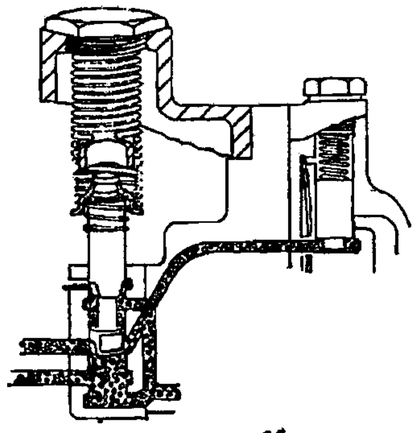
With the Shift Lever "OFF", the valve that controls oil pressure to rear Planetary Unit is in the same position as when in "HIGH" Forward. Therefore, when oil pump builds up pressure, the transmission will be shifted into Direct Drive.

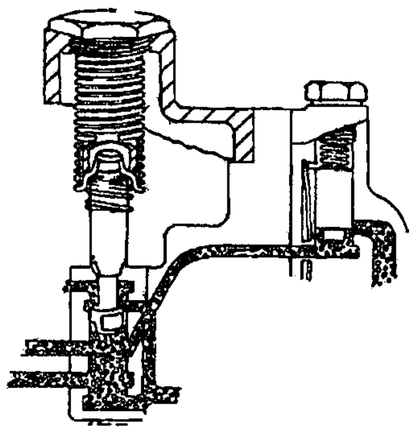
The small gears are capable of building up sufficient oil pressure to insure lubrication through the transmission and to shift transmission into Direct Drive.

When Shift Lever is in "Forward" position, both large and small drive and driven gears operate together and force lubrication through the transmission, and to Planetary Units and Servos when required.

When the Shift Lever is in "Rev" position, the pump serves but one purpose, and that is to lubricate transmission parts. The larger section of the pump which is driven by the engine will operate in a direction opposite to that of the small section of pump which is driven by rear wheels.

AS A RESULT the total volume of oil delivered by pump will be the difference in volume produced by the two sections.





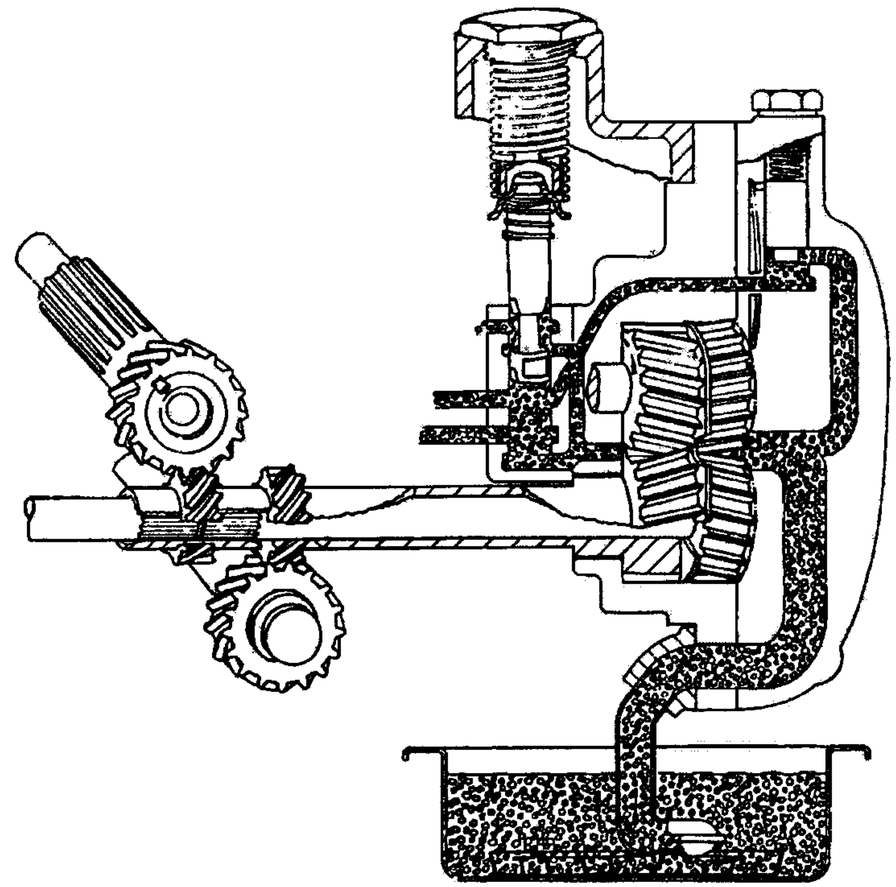
The oil pump output flows to Pressure Regulator Valve where it is distributed to oil control unit and the Lubrication System.

As oil pressure builds up, the Pressure Regulator Valve is lifted from its seat to its pressure regulating position which is approximately 85 pounds pressure. At this position of the valve the excess oil is by-passed to oil pan.

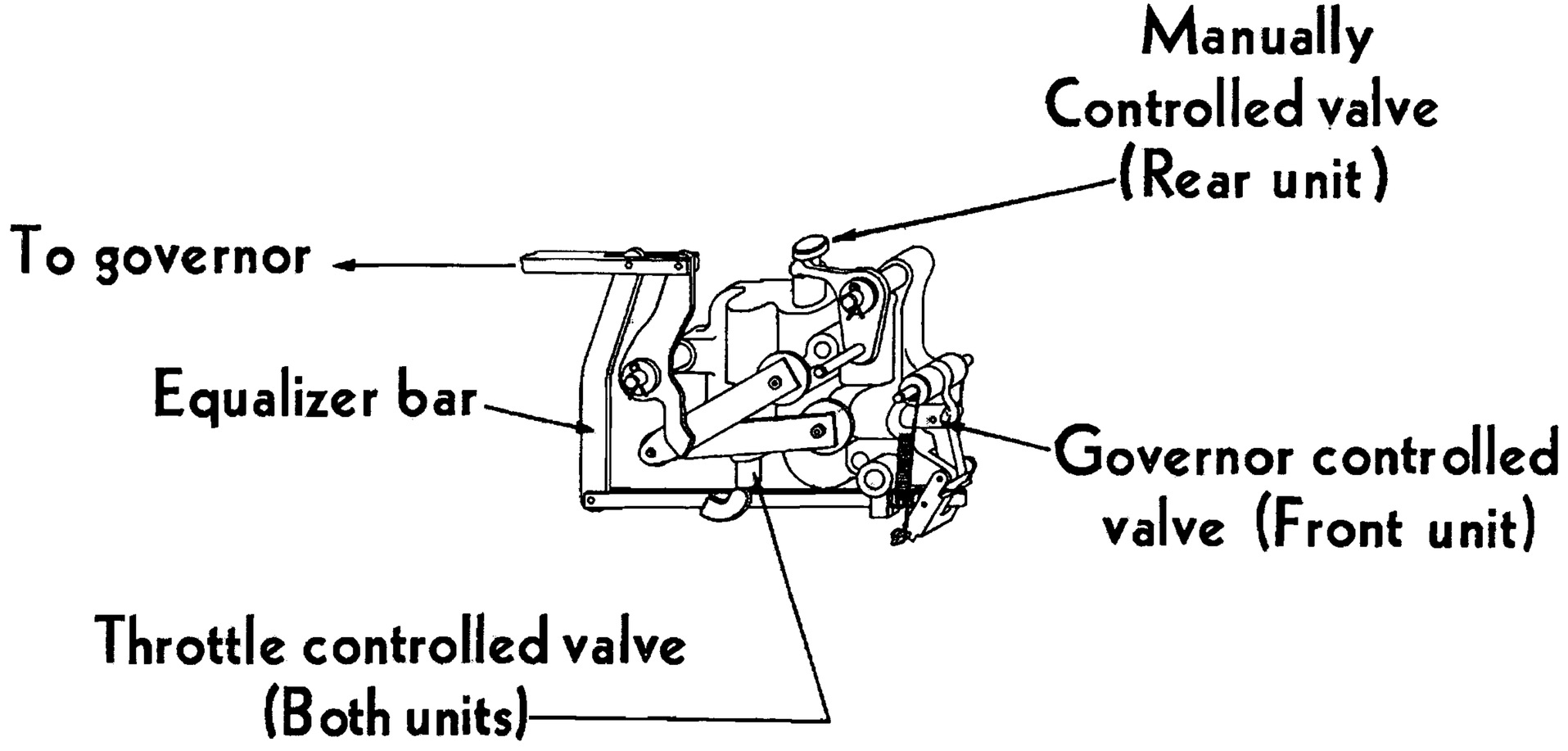
With Shift Lever in High Range and as car speed drops to where only 45 pounds pressure is maintained by the pump, pressure regulator valve drops back to its seat. The transmission now shifts into Low gear.

Approximately 85 lbs. per square inch hydraulic pressure is maintained for all higher speeds of pump. Distribution of the hydraulic (control) pressure to the different points of transmission as changing conditions of driving demand, is controlled by three oil valves incorporated in a single valve body.

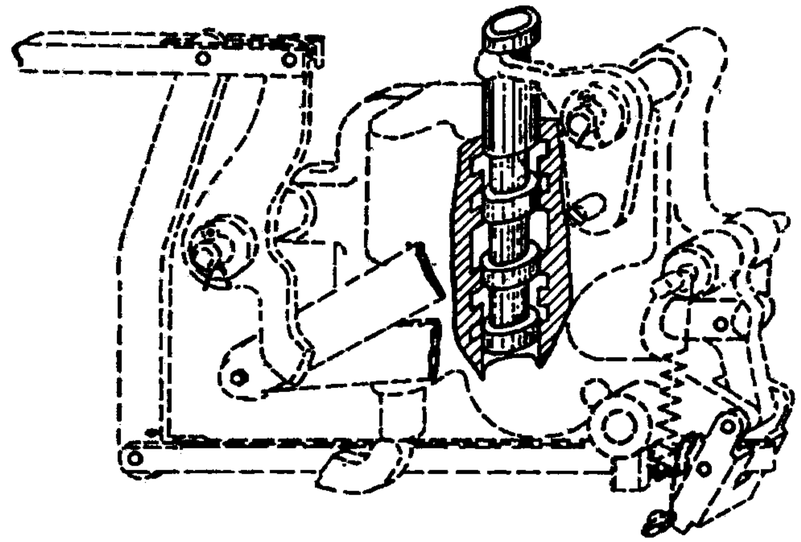
There is also a by-pass valve on the external cover of the oil pump which regulates oil pressure to the Lubrication system by providing a by-pass of excess oil back to the suction side of oil pump.



Distribution of the hydraulic pressure to the different points of the transmission as changing conditions of driving demand is controlled by three valves incorporated in a valve body.

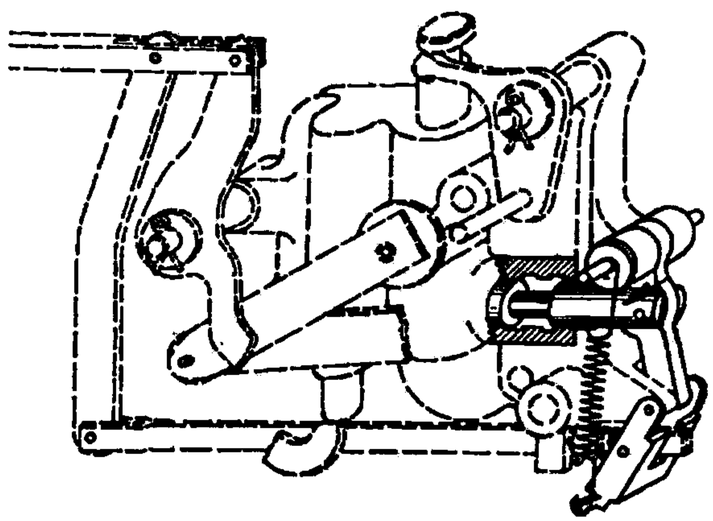


MANUALLY CONTROLLED VALVE



This valve, as was stated previously, is operated manually when the Control Lever is moved from Low Range to High Range, and affects only the rear planetary unit.

GOVERNOR CONTROLLED VALVE

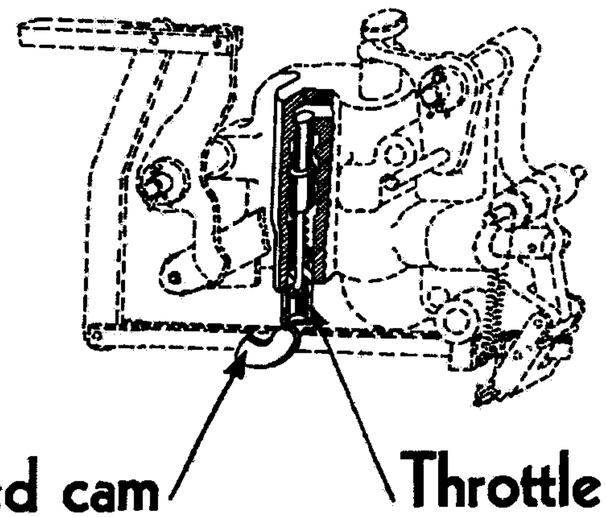


Another valve is actuated automatically by a governor driven from the input shaft of the front planetary unit, and affects only the front planetary unit.

Note: This shaft always turns when car is moving at the correct engine speed for any gear reduction.

THROTTLE CONTROLLED VALVE-

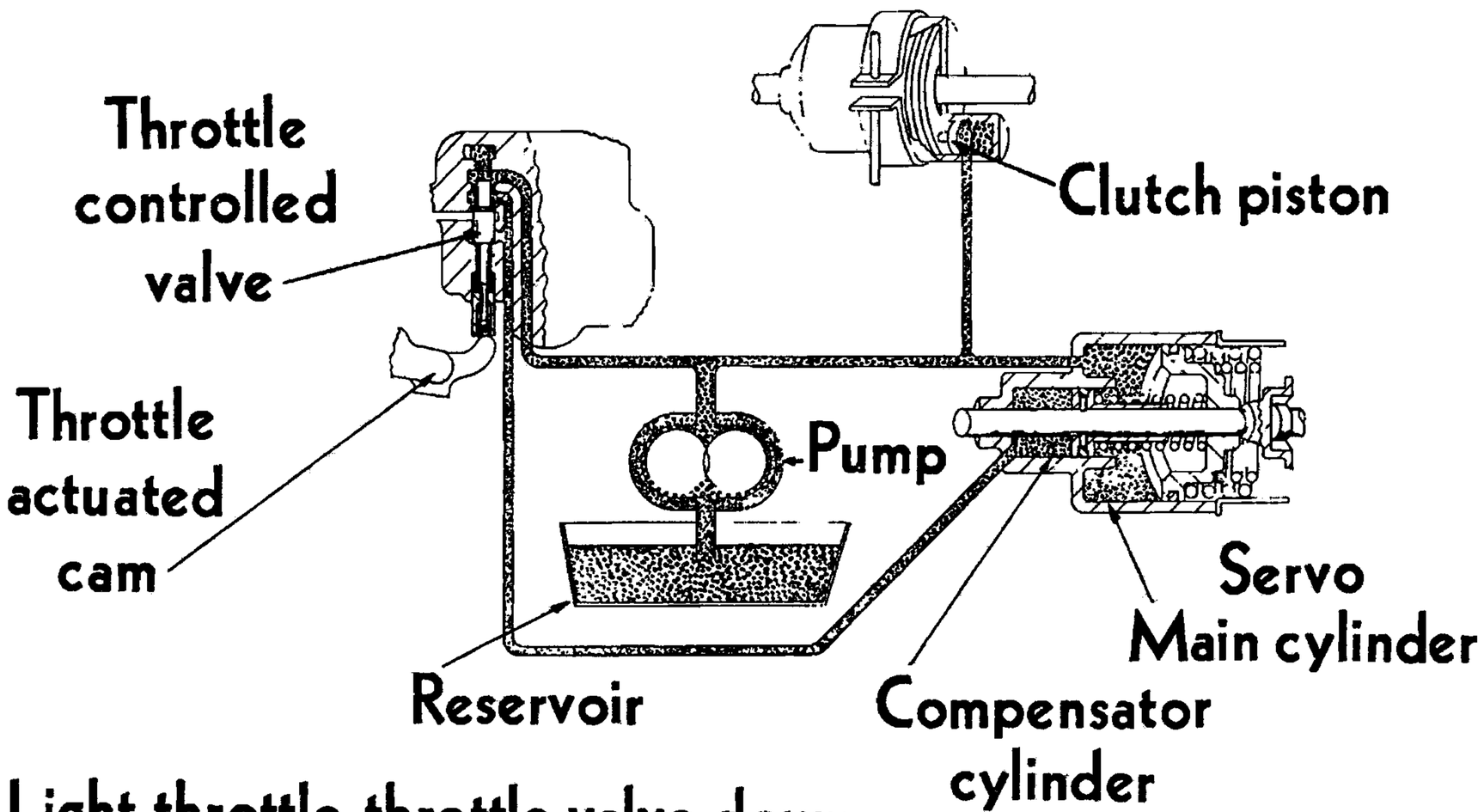
With a light throttle, it is desirable to have a soft clutch engagment or with a heavy throttle a firm engagment during the automatic shift.



This is accomplished by a valve known as the throttle controlled valve. This controls the oil to a compensator cylinder in servos, which in turn controls the rate of clutch engagment.

The throttle controlled valve does not cause shifting. It's sole function is to bring about smooth shifts at various throttle positions.

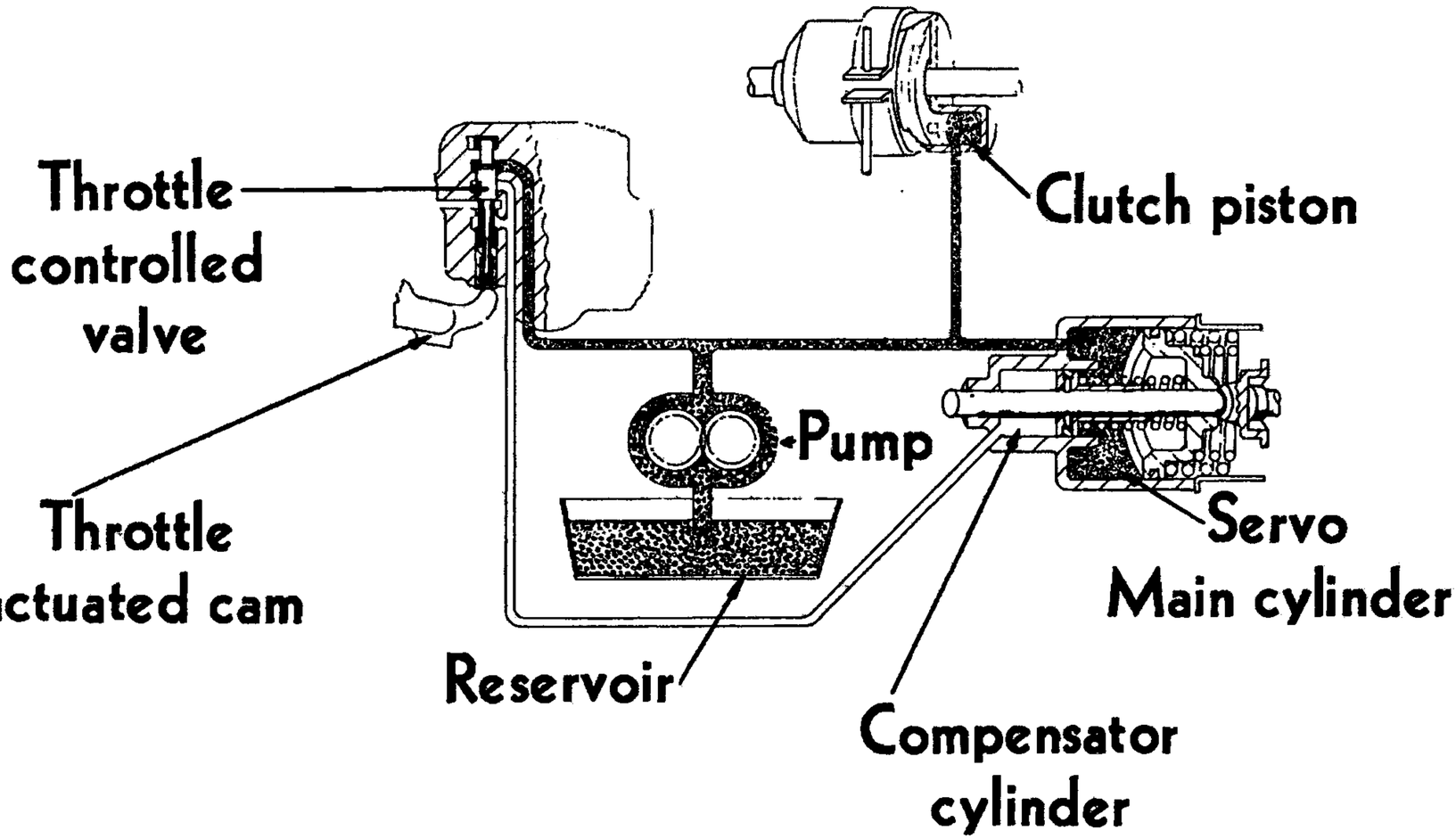
THROTTLE CONTROLLED VALVE (DOWN)



Light throttle-throttle valve down.

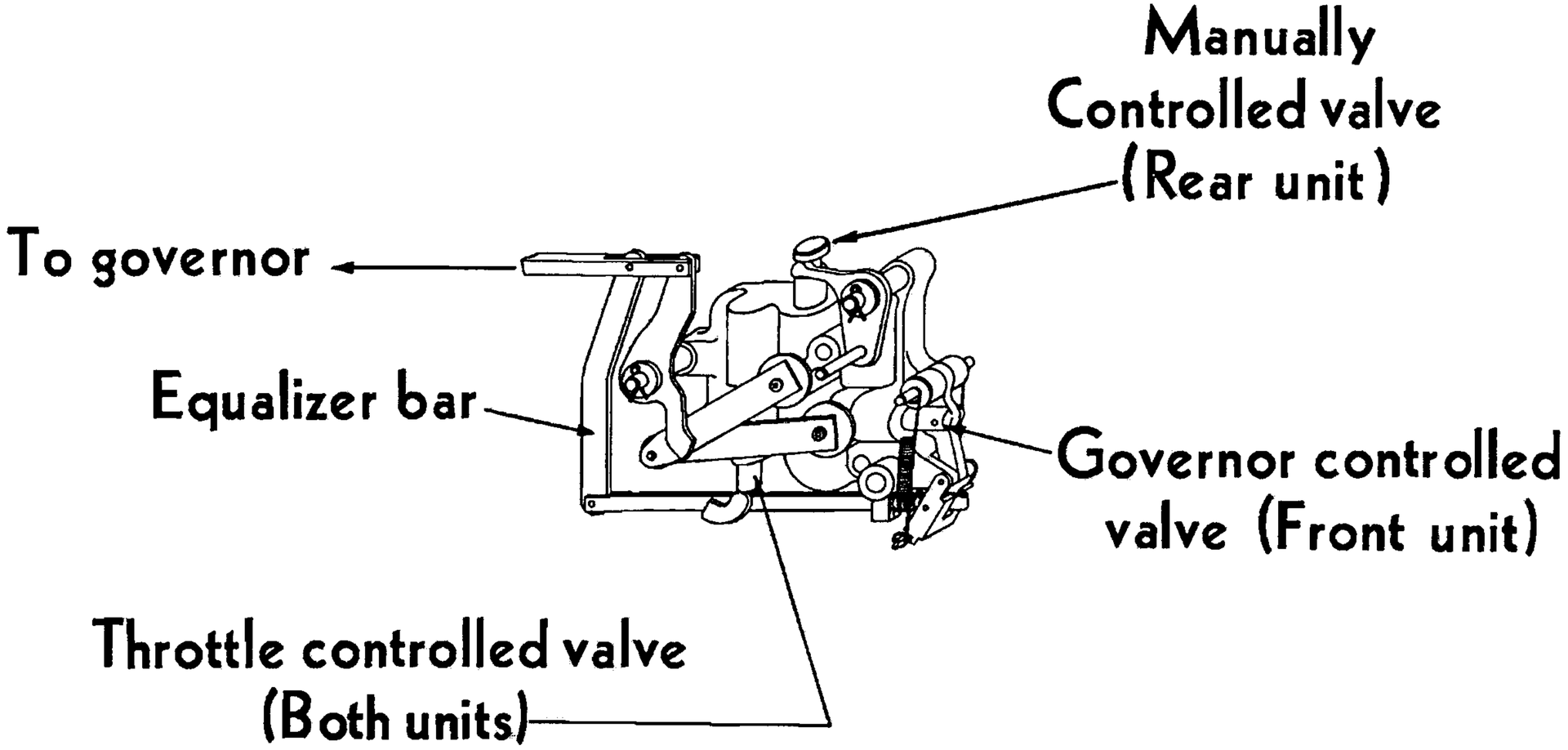
Oil admitted to compensator cylinder. Low pressure is required to force back servo spring because compensator piston assists in pushing back servo spring. This lowered pressure results in easier application of clutch.

THROTTLE CONTROLLED VALVE (UP)



Heavy throttle - Throttle valve lifted-
No oil flow to compensator cylinder - therefore a high pressure is required to force back servo spring because there is no assistance from compensator piston. This high pressure results in a firm clutch engagment.

Distribution of the hydraulic pressure to the different points of the transmission as changing conditions of driving demand is controlled by three valves incorporated in a valve body.



SERVICING

Buick

Self-Shifting Transmission

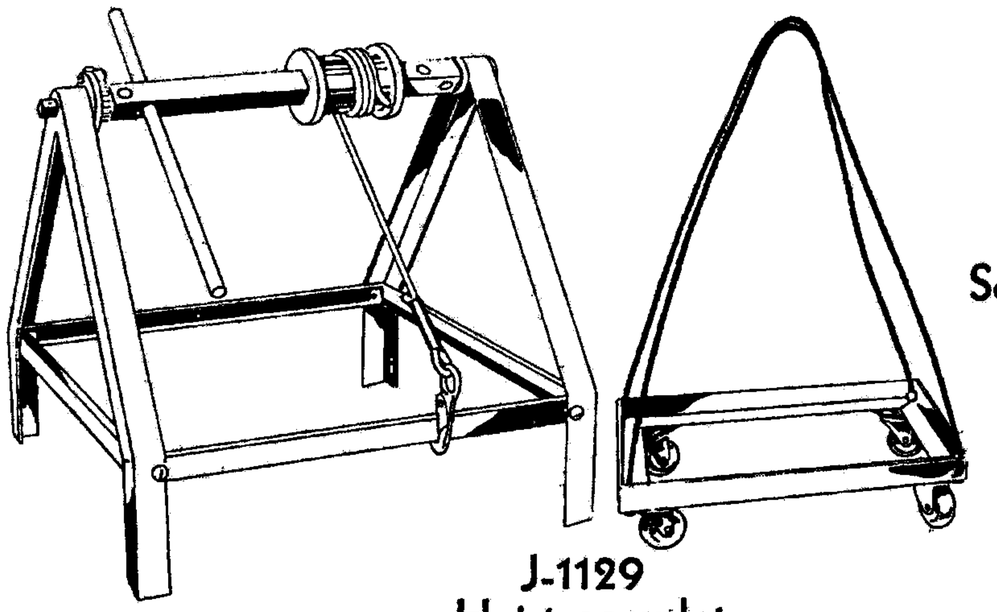
52

SPECIAL PARTS REQUIRED TO REPLACE STANDARD PRODUCTION PARTS WHEN *Self-Shifting Transmission* IS USED

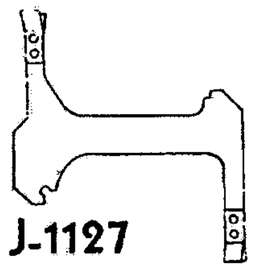
Exclusive of *Self-Shifting Transmission* which includes - Clutch gear
- Speedometer drive gears
- Universal joint

the special parts are-

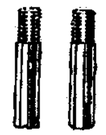
Flywheel housing
Clutch driven disc
Clutch bearing retainer and spring washer
Transmission steady rest and rubber mountings
Torque tube assembly
Propeller shaft assembly
Differential case, ring gear and pinion
Speedometer driver, flexible drive flexible casing
Steering gear assembly
Throttle linkage
Front floor center panel
Front floor mat and its retainer at steering column
Combination fuel and vacuum pump



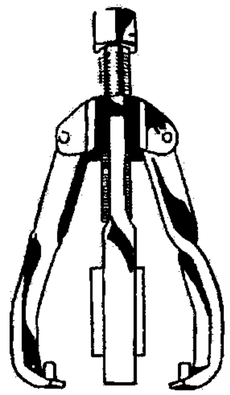
J-1129
Hoist complete



J-1127
Servo Gauge



J-1126
Aligner Studs



J-1120
Steering Wheel Puller

J-1122
Servo cam
release bar

The following tools are essential for servicing the *Self-Shifting Transmission*:

J-1120	Steering Wheel Puller
J-1127	Servo Gauge
J-1122	Servo cam release bar
J-1126	Aligner Studs
J-1129	Hoist complete

These tools are available through Hinckley Myers Company; Jackson, Michigan.

All Buick dealers should obtain above tools or their equivalent.

ENGINE TUNE-UP

Proper operation of the *Self-Shifting Transmission* is dependent on-ENGINE PERFORMANCE, particularly the carburetion. Idle speed must be 5 to 6 M.P.H. IN THIRD SPEED. To be certain the car is in the 3rd speed ratio, move shift control to 2nd "F" (forward) position, accelerate to approximately 12 M.P.H. and allow car to slow down again to idling speed which should be 5 to 6 M.P.H.

INITIAL POLICY RELATIVE TO SERVICING SELF-SHIFTING TRANSMISSIONS.

At this time service will be limited to the following:-

Lubrication

Setting of Throttle Control Lever

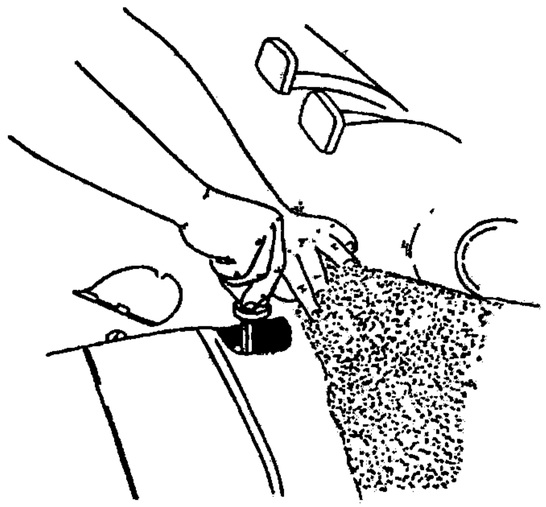
Setting of Manual Control Lever

Setting of Servo Bands

Removal and Replacement of *Self-Shifting Transmission*

Assembly

LUBRICATION



Transmission should be checked for oil level at pre-delivery and each 1000 miles thereafter and must be kept full at all times.

Oil should be selected on the basis of minimum atmospheric temperature.

MINIMUM	GRADE	MAXIMUM
If it is anticipated the minimum atmospheric temperature will be-	Use the grade of engine oil indicated -	Which will be satisfactory at atmospheric temperature -
40°F	SAE 30	Above 40°F
30°F	SAE 20	Up to 75°F
10°F	20W	Up to 75°F
-10°F	10W	Up to 40°F
-30°F and below	10W + 10% Kerosene	Up to 20°F

It will be the duty of selling dealers to advise owners of:

THE LUBRICATION REQUIREMENTS OF BUICK CARS EQUIPPED WITH *Self-Shifting Transmission*

Use only clean oil. If more than one quart low there is danger of cavitating (sucking air).

Oil should be changed and pan should be cleaned when removed.

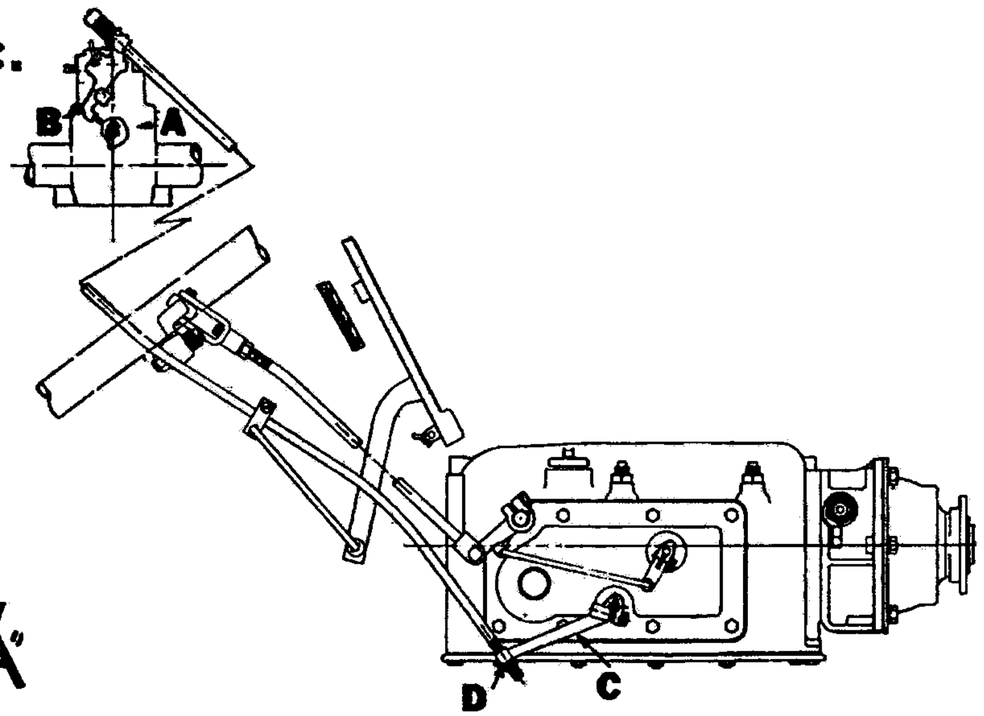
Do not use shellac, permatex, or any sealer whatsoever on any transmission gaskets (except transmission to flywheel housing).

Oil is never "used-up" or diluted. It can only be lost thru leaks or become "dirty" from worn particles.

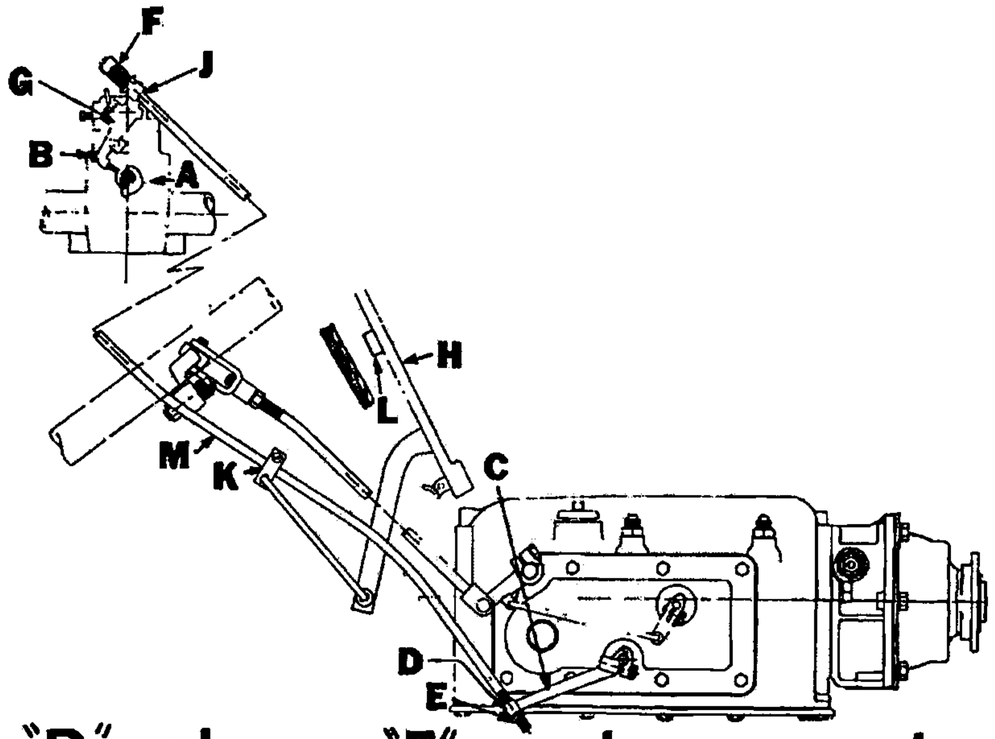
SETTING OF THROTTLE CONTROL LEVER

The throttle lever should always be reset if for any reason the transmission is removed and then reinstalled or replaced in a car, or if changes have been made at carburetor that would affect setting of throttle valve or linkage.

PROCEDURE



1. Revolve cold idle cam "A" to hot position.
2. With throttle adjusting screw "B" set to idle engine at 5-6 M.P.H. in 3rd speed, close throttle against cam "A"
3. Disconnect trunion "D" and move throttle control lever "C" upward until it comes against stop inside transmission. Adjust trunion "D" until pin will just enter lever "C". Now "lengthen" trunion "D" two complete turns (this is to allow for slight changes in throttle adjusting screw "B") and a more positive return of throttle lever to idle position.



4. Lock trunion "D" with nut "E", making sure that the detent spring "F" is at right angles to throttle lever "G".

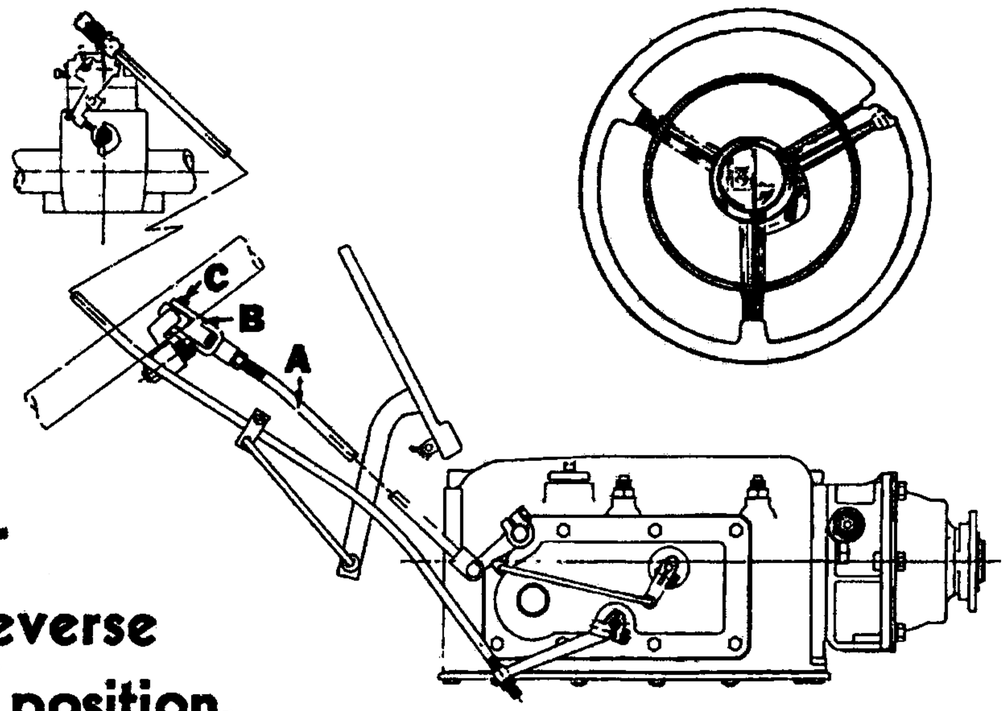
5. Depress accelerator pedal "H" until its stop "L" is against floor mat and observe if detent flat spring "F" overtravels approximately 1/8 on trunion "J". If it does not, clip "K" should be moved "up" the accelerator rod "M" sufficiently to give rod necessary additional travel.

When above adjustments are correctly made, lever "C" will reach its downward travel limit when accelerator pedal stop "L" is touching floor mat.

SETTING OF MANUAL CONTROL LEVER

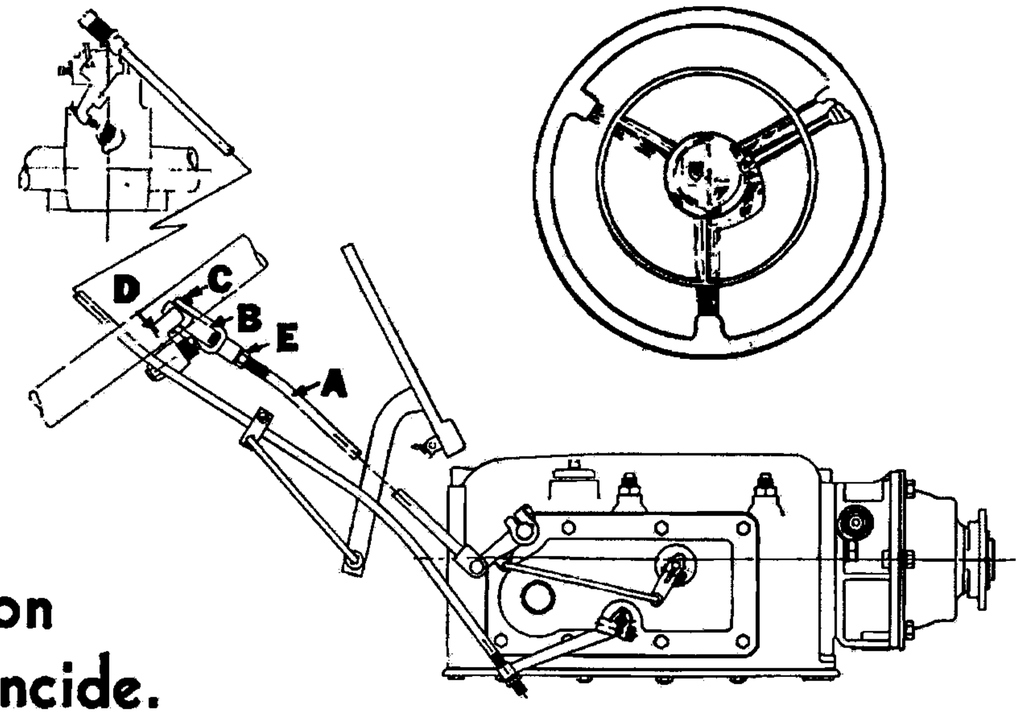
It is important that the manual control lever setting be made each time transmission is removed and reinstalled, or replaced.

1. Move hand shift lever to "N" (neutral) position.
2. Disconnect transmission lower control lever rod "A" from forward and reverse lever at lower end of hand control shaft.



3. Make sure forward and reverse shift lever is located in "N" position. This position can be ascertained by pulling control lever rod "A" forward with hand as far as possible and then moving it back until one notch (detent) is felt.
4. Adjust clevis "B" on control lever rod "A" until clevis pin "C" enters freely into hole in lever.

5. Assemble control lever rod "A" to lever "D", using clevis pin and cotter key lock clevis nut "E".



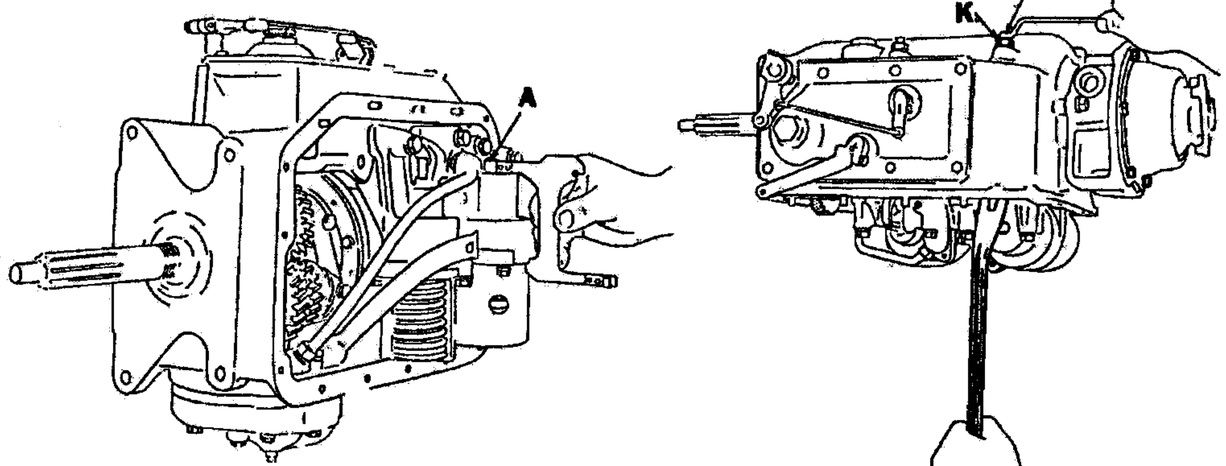
6. Recheck adjustment of manual control at inside of car to make sure detents in transmission and at shift lever box coincide. To do this, press on button of hand control lever and move lever up and down from "N" position until resistance of detent in the transmission is felt. The points where resistance begins to increase noticeably should be of equal distance above and below the "N" position point on control lever box.

As a further check, again push button in at end of control lever and move lever downward from "N" position until click from transmission is felt, indicating transmission is in either "F" position. Arrow on shift lever should now line up with arrow at forward position of shift lever box.

SETTING OF SERVO BANDS

The setting of both the front and rear planetary unit servo bands will be made at the completion of first 5000 miles (to take up for initial wear) and thereafter as required, by reason of wear, or when setting has been disturbed for any reason. The 5000 mile setting is strictly a maintenance item which should be paid for by the customer.

PROCEDURE



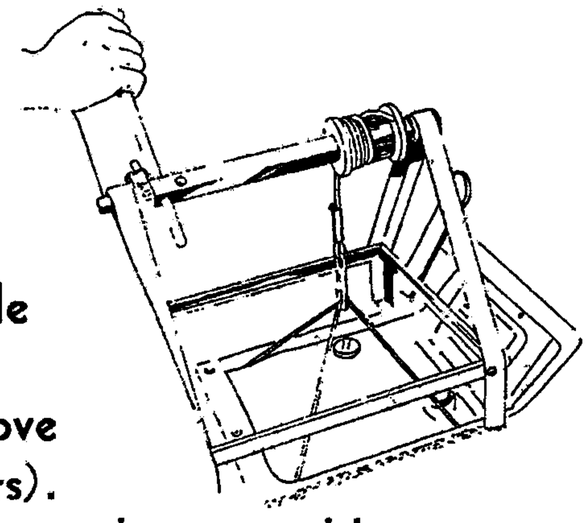
1. Protect front cushion with cover, remove floor mat and center floor panel.

(Two mechanics are required for remaining operations, one to remain in car, the other under car).

2. Raise car on lubrication lift.
3. Drain oil from transmission by removing drain plug in oil pan. 4. Remove oil pan.
5. Check pin "A" using servo gauge J1127 on rear servo and if adjustment is necessary mechanic under car will force pin "A" into rear servo. Mechanic inside of car will at the same time loosen lock nut "K" and take up slack in servo bands by turning set screw "J" downward until mechanic beneath car observes that circumferential edge of servo pin is flush (+ or -1/64") with outer edge of servo gauge. This observation should be made with release bar removed and gauge held in place.
6. Use same procedure for adjusting front planetary servo brake band.
7. Wash oil pan clean and replace. 8. Lower car. 9. Replace floor center panel.
10. Fill transmission with proper oil to full mark on oil level stick. 11. Replace floor mat.

REMOVAL OF *Self-Shifting Transmission*

Because of the weight of the *Self-Shifting Transmission* (145 pounds) it is not advisable to risk any failure of hoist by lying under the transmission when transmission is not held in position by at least two bolts.



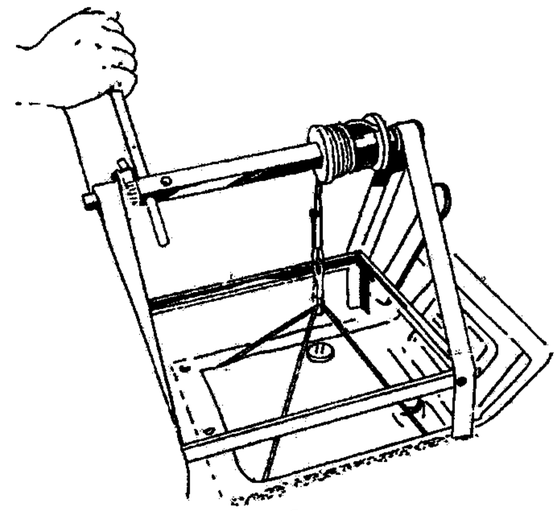
PROCEDURE:

With rear axle removed, (described in Shop Manual under Rear Axle) :

1. Push front seat assembly back as far as possible and cover front seat cushion.
2. Remove floor mat (it is not necessary to remove accelerator pedal on *Self-Shifting Transmission* cars).
3. Remove center floor panel.
4. Disconnect speedometer cable at transmission.
5. Remove two upper transmission to flywheel housing attaching bolts.
6. It is desirable at this time to have front of car slightly higher than the rear to assist in sliding transmission backward.
7. Remove clutch housing pan.
8. Remove clutch release yoke.
9. Disconnect throttle linkage at throttle control lever on left side of transmission case.
10. Disconnect manual shift rod at clevis connection.
11. Place transmission lifting tool J-1129 in front compartment over floor opening.
12. Place cradle of lifting tool under transmission and fasten cables to hoist hook. Raise transmission just enough to support transmission when remaining bolts are removed. Be certain that hoist is securely locked.
13. Remove both upper transmission to flywheel housing bolts.
14. Slide transmission toward rear and at same time work clutch release bearing retainer out with transmission.
15. Lower transmission to floor and slide from under car.
16. Remove transmission steady rest.

INSTALLATION OF *Self-Shifting Transmission* ASSEMBLY

PROCEDURE:



1. Shellac new gasket to front of transmission housing.
2. Screw aligner studs, Tool J-1126, into two upper flywheel housing bolt holes.
3. Install clutch release bearing on retainer and place it in flywheel housing with gasket and spring washer.

   NOTE: The spring washer used with *Self-Shifting Transmission* is part number 1304037 and is "waved" instead of "cupped".

4. By means of hoist J-1129 raise transmission until clutch gear is even with opening at rear of clutch housing, then slide transmission forward to proper location against flywheel housing, guiding it on guide pins into clutch driven disc.

   NOTE: Do not allow any weight to rest on clutch driven plate hub.

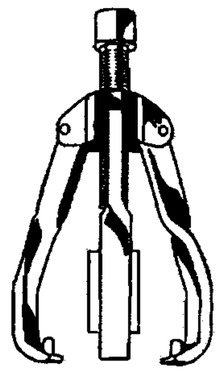
5. With hoist still in place and securely locked, install and tighten two bottom transmission to flywheel housing bolts. 6. Remove lifting tool cradle from transmission. Remove hoist.
7. Remove guide pins. 8. Install two upper attaching bolts. 9. Retighten two lower bolts.
10. Install transmission steady rest. 11. Install clutch release yoke.
12. Reassemble flywheel pan to housing. 13. With hand shift lever in "N" (neutral) position, and shift lever on transmission in neutral, assemble transmission shift rod to transmission lever, with anti-rattle washer between clevis yoke and lever. Install cotter key and lock. NOTE: To set shift lever on transmission in "N" position, move lever as far forward as possible by hand, then move it back one notch (2nd detent position).
14. Check throttle control lever and manual control lever settings as described under those sections. 15. Assemble speedometer cable to transmission. 16. Install floor center panel.
17. Fill transmission to full mark on oil level stick with correct engine oil.
18. Install floor mat. 19. Install rear axle.

SERVICE OF STEERING ON CARS EQUIPPED WITH

Self-Shifting Transmission

Due to the closeness of control lever housing, it will be more difficult to remove a steering wheel.

A new steering wheel puller, Tool J-1120, has been developed which will work equally well on all models using the horn ring type of flexible wheel.



J-1120 Steering Wheel Puller

Other service operations on the steering gear are the same as on standard cars.

If any service is performed which would disturb the setting of the manual control lever, such as post location, it will be necessary to check manual control lever setting. (See procedure under that item.)

. . . To start a stalled engine by towing the car.

1. Disengage clutch and move shift lever to "High" Range position.
2. Tow the car. When a speed of 10 M.P.H. is reached, turn the ignition switch "ON" and engage the clutch.

This will turn the engine in 3rd gear.

To tow car (without cranking engine) shift the control lever to "N" (neutral). The transmission will turn in 4th gear (direct).

If this procedure is not followed, the car will turn the engine in 1st. gear, which on slippery roads would cause the wheels to slide.

When a *Self-Shifting Transmission* fails to function properly, check and correct if necessary, the following:-

Engine tune-up (particularly carburetion)

Lubrication

Setting of throttle control lever

Setting of manual control lever

Setting of servo bands

If performing these operations does not correct the difficulty, communicate with the Zone Office in each instance, as policies relative to *Self-Shifting Transmission* will change as experience indicates it is advisable.

At the beginning of the model, each Zone Office will be supplied with one or two assemblies TO BE USED IN EMERGENCY CASES ONLY. In the event one of these transmissions is furnished the dealer by the Zone, it should be charged to dealer, on a Zone Sundry Invoice, Form S-123-2. The Zone will then place an order with the factory for shipment of a new assembly direct to the Zone Office.

The *Self-Shifting Transmission* assembly will not be carried in stock at G.M.P.D. warehouses.

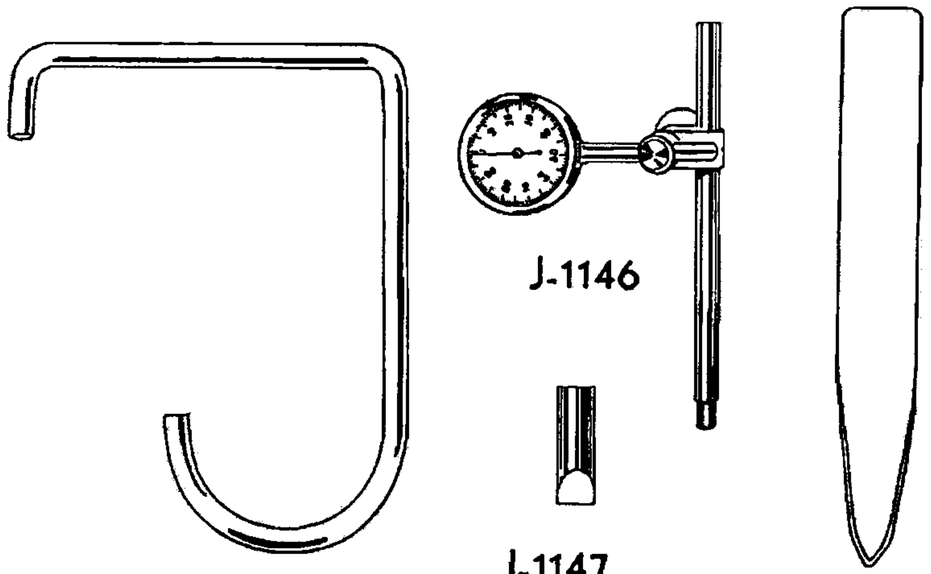
However, if difficulty is of such a nature that the owner can drive the car for a few days, the dealer should be instructed to place an order through the factory.

In any event, the dealer should return original assembly with an A.F.A to the Zone M.R. room for credit immediately after removal.

The shipping crate will be built so that it can be used indefinately and care should be used to avoid damage when uncrating. The transmission must at all times be shipped in the factory crate.

Those pages following, which deal with assembly and disassembly of *Self-Shifting Transmission*, are simply for general information when required.

The following additional tools are desirable when the transmission is assembled or disassembled.



J-1148

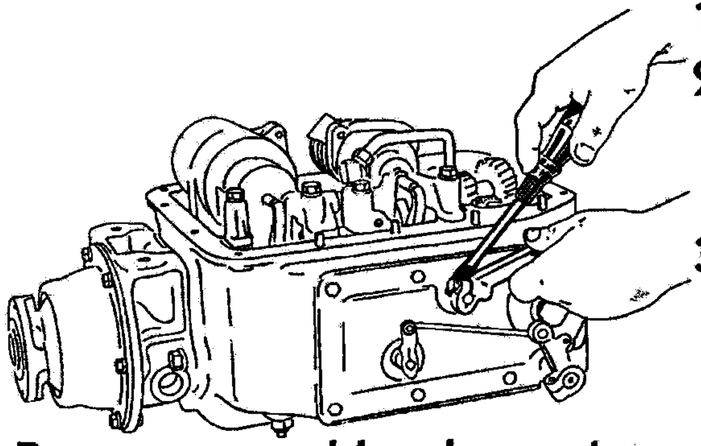
J-1146

J-1147

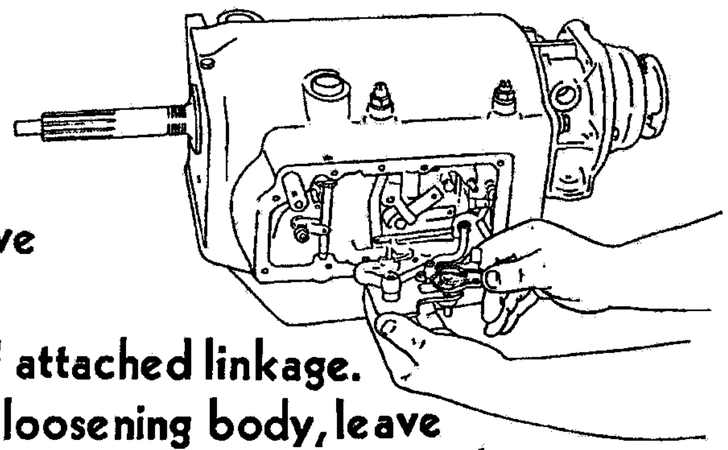
J-1149

SEQUENCE OF REMOVAL
COMPONENT UNITS OF *Self-Shifting Transmission*

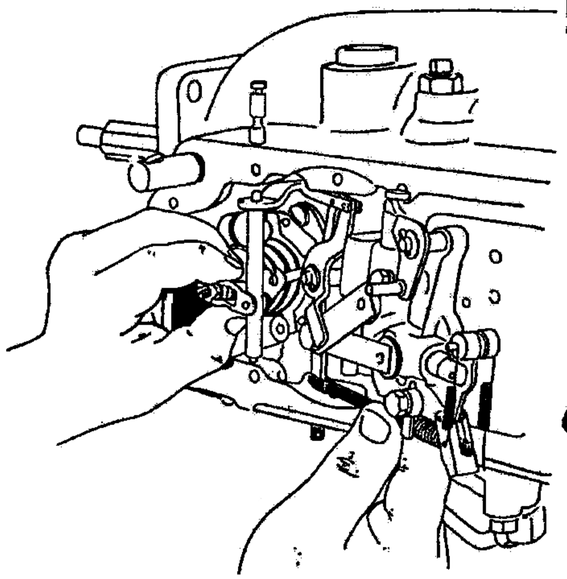
With transmission removed from car:



1. Remove oil pan.
2. Remove three control levers over side plate. (See illustration.) It is not necessary to remove woodruff keys or pin which position levers .
3. Remove side plate and gaskets.

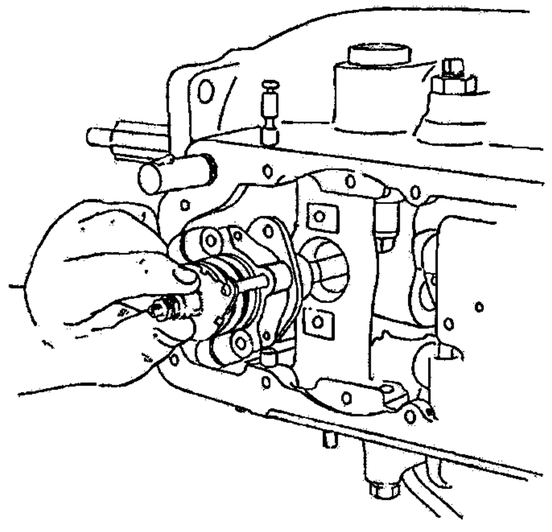


4. Remove control bracket and attached linkage. (See illustration.) Care must be exercised to remove tube without damaging same.



5. Remove valve body and attached linkage. (See illustration.) After loosening body, leave cap screw positioned in valve body to retain dampening valves. The linkage at governor pivots on pins locked in case by two of the screws holding side plate to case. The upper pin is fitted free while lower pin is a light press fit. Sliding free pin upward will permt linkage to be disconnected.
6. Remove pressure regulating valve spring. The pressure regulator cushion spring should remain on valve as upper coil is designed to fit close on valve stem. NOTE: It is important that this is correctly assembled with tight coil on top.
7. Remove oil pump. Care must be exercised to prevent damage to the driven gears as assembly is withdrawn.

SEQUENCE OF REMOVAL (Cont'd.)



8. Remove governor. (See illustration.)
9. Remove oil line between pump and servo body.
10. Remove pump suction line and gasket.
11. Loosen servo setting screw at top of case until screw is free. Use pry bar, Tool J-1122, when loosening to remove load from adjusting screw threads.
12. Loosen all screws evenly holding both servos. This will prevent bending connecting tubes. Remove servo units together, exercising care to prevent bending of connecting tubes.
13. Remove counter gear and reverse idler gear. Shafts for these are identical, however, should not be interchanged because of selected fits in case, but should be marked for identification.
14. Remove clutch gear, bearing and retainer as an assembly. This is held by snap ring in outer diameter. This ring must be expanded by a wedge-shaped tool J-1149 inserted in a recess in case, which will spread ring (into groove in case) and permit pulling out clutch gear.

    A thrust bearing consisting of two thrust races and three balls will come apart when clutch gear assembly is removed.

SEQUENCE OF REMOVAL (Cont'd.)

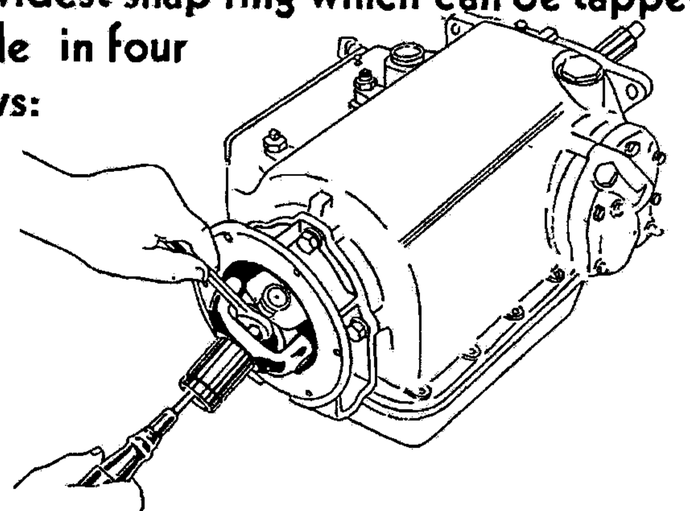
15. Move shifter shaft to reverse position. Remove shifter shaft lock screw and shifter shaft. The detent ball will be loose when shaft is withdrawn. Remove shifter fork and sliding gear.
    (When completely dis-assembling transmission it will be convenient to perform this operation last. For changes involving head gear set it will have to be performed at this point.)
16. Remove ball joint.
17. Remove universal joint. This is a light press fit and can be removed without a puller.
18. Remove rear transmission retainer (end plate).
19. Remove transmission center bearing cap.
20. Rotate servo bands with ends toward bottom of transmission and clamp ends with a modified brake cylinder clamp.
21. Both planetary units must be lifted together from the case. It will prove very convenient to use Tool J-1148 as a handle for lifting unit at its approximate center of weight, making sure that front shaft is not pulled out of its position.

INSTALLATION OF COMPONENT UNITS IN *Self-Shifting Transmission*

Reversing removal procedure will give correct installation sequence.

There are four (4) settings which must be made at the time of assembly to compensate for wear or manufacturing tolerence. These are:

1. End motion at front bearing. This is controlled by the selection of snap rings between front bearing outer race and retainer, by selecting the widest snap ring which can be tapped lightly into the front groove. These snap rings are made in four (4) different widths. The width dimensions are as follows:



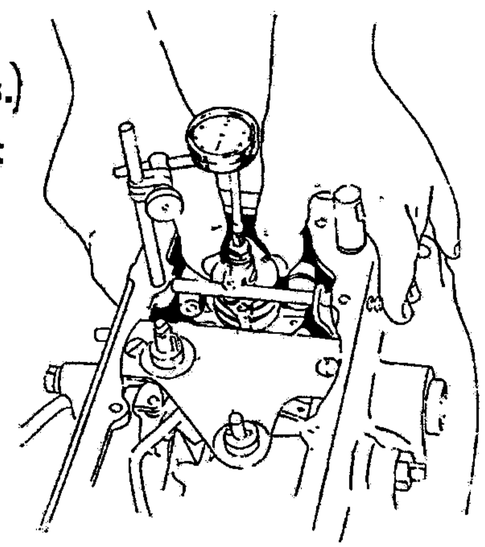
SNAP RING WIDTHS AND CODE

Part Number	Width	Code
1304060	.063"	White
1304061	.067"	Yellow
1304062	.071"	Green
1304063	.058"	Red

2. Main shaft end clearance . After the units are all assembled in case and universal joint front yoke is tightened in place (with cap screw and washer) turn the adjusting screw up solidly with a screw driver then back same off 1/3 turn and lock the screw with nut. This will give correct end clearance and assure proper lubrication of all thrust surfaces in the line drive parts.

3. Setting servo bands (See procedure under Setting Servo Bands.)

4. Governor setting. After governor assembly is installed, it must be checked by using a dial indicator, (shown in accompanying illustration) set so that when the governor weights are "opened" by hand the center of governor travels .200" to .220" just as valve "throws" to open position. The valve should close (throw back) when governor weights move back (close) .040" to.030" reading. If it does not close at from .040" to .030", adjust to closing limits and compromise if necessary for opening dimensions.



INSTALLATION OF COMPONENT UNITS OF

Self-Shifting Transmission (Contd.)

GENERAL

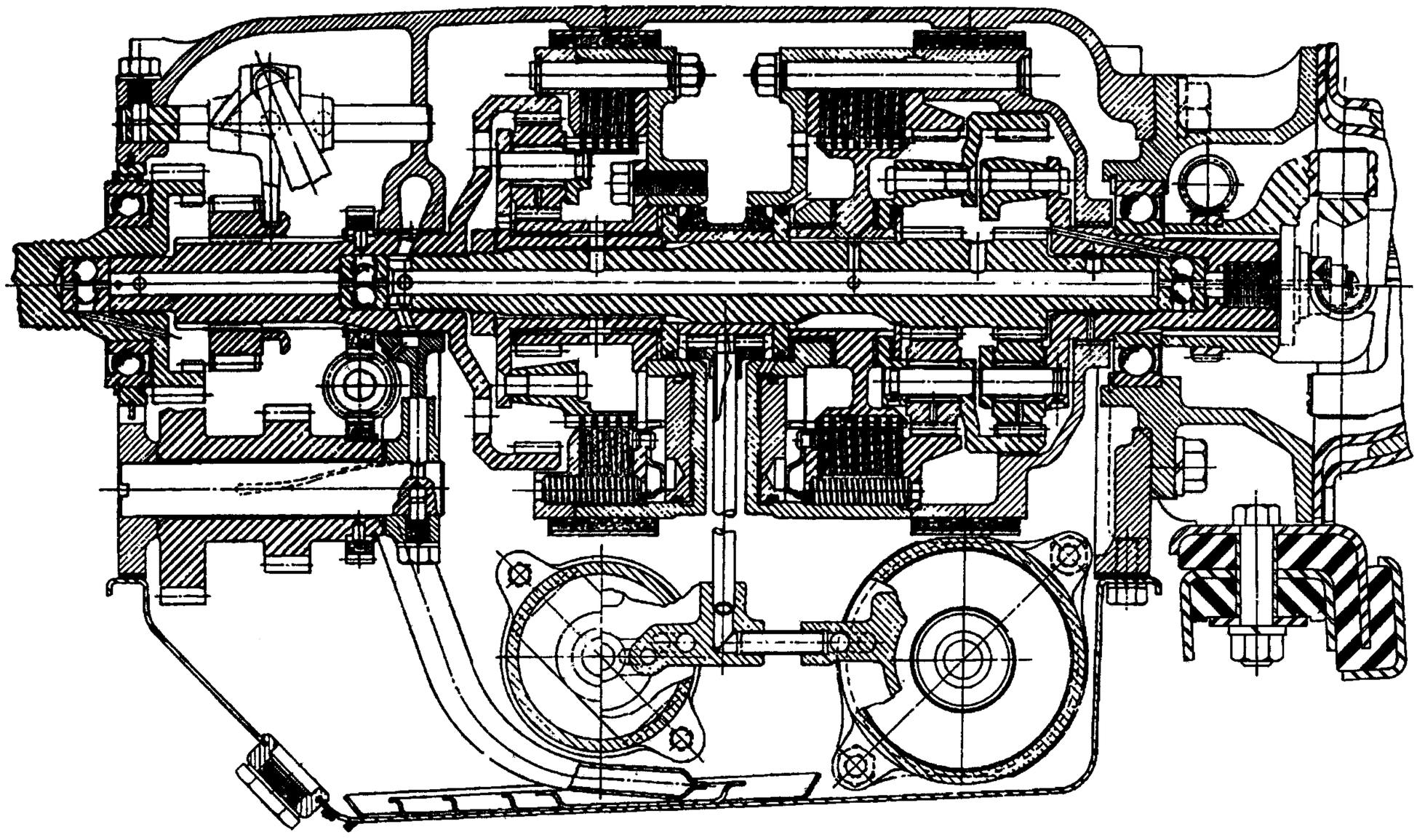
When assembling a transmission the following details should be observed:

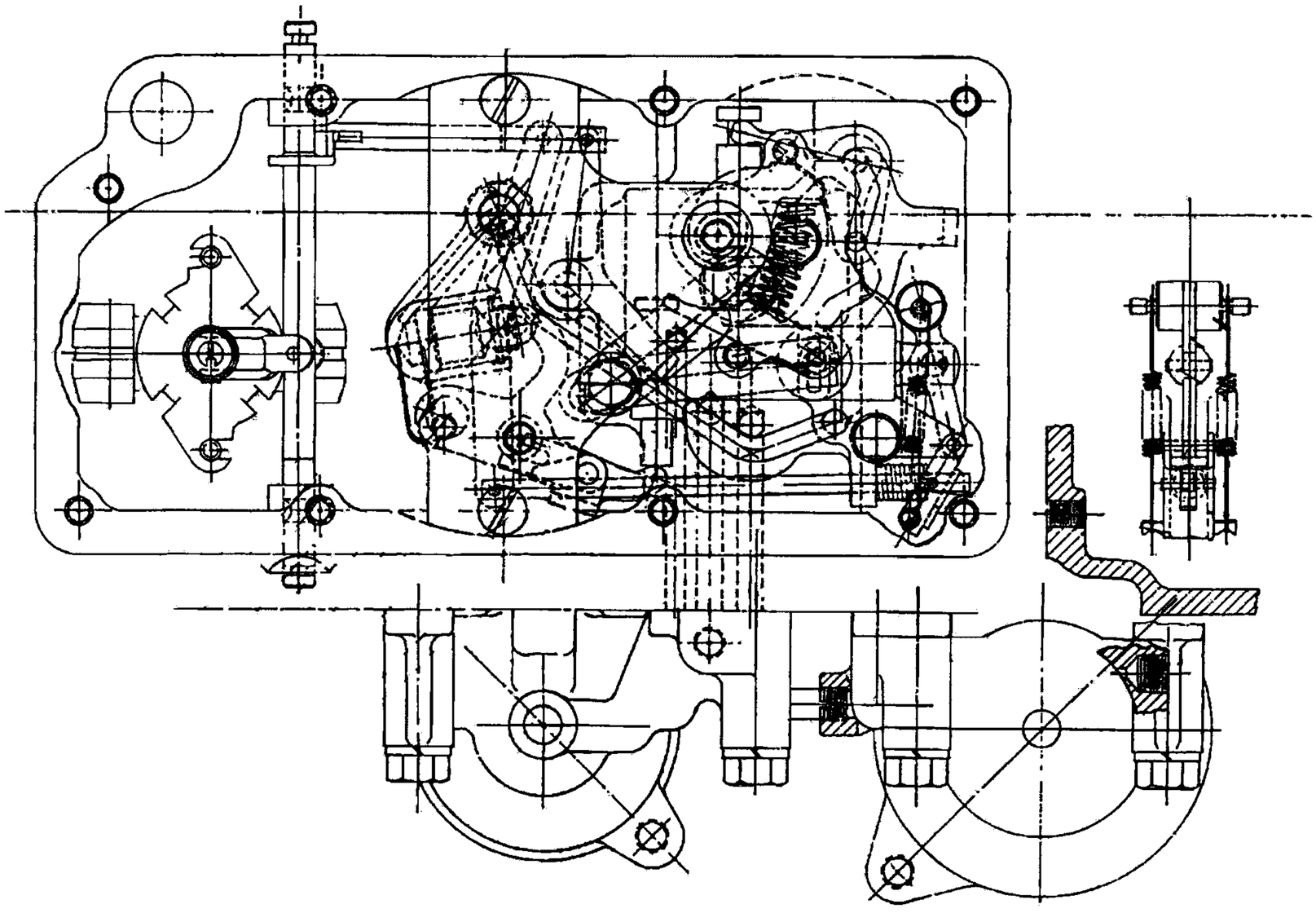
When installing the countershaft or reverse idler shaft, the front end which fits in the case should be sealed with Enginamel, Permatex No. 1 or 2, Red Lead or White Lead. DO NOT USE SHELLAC.

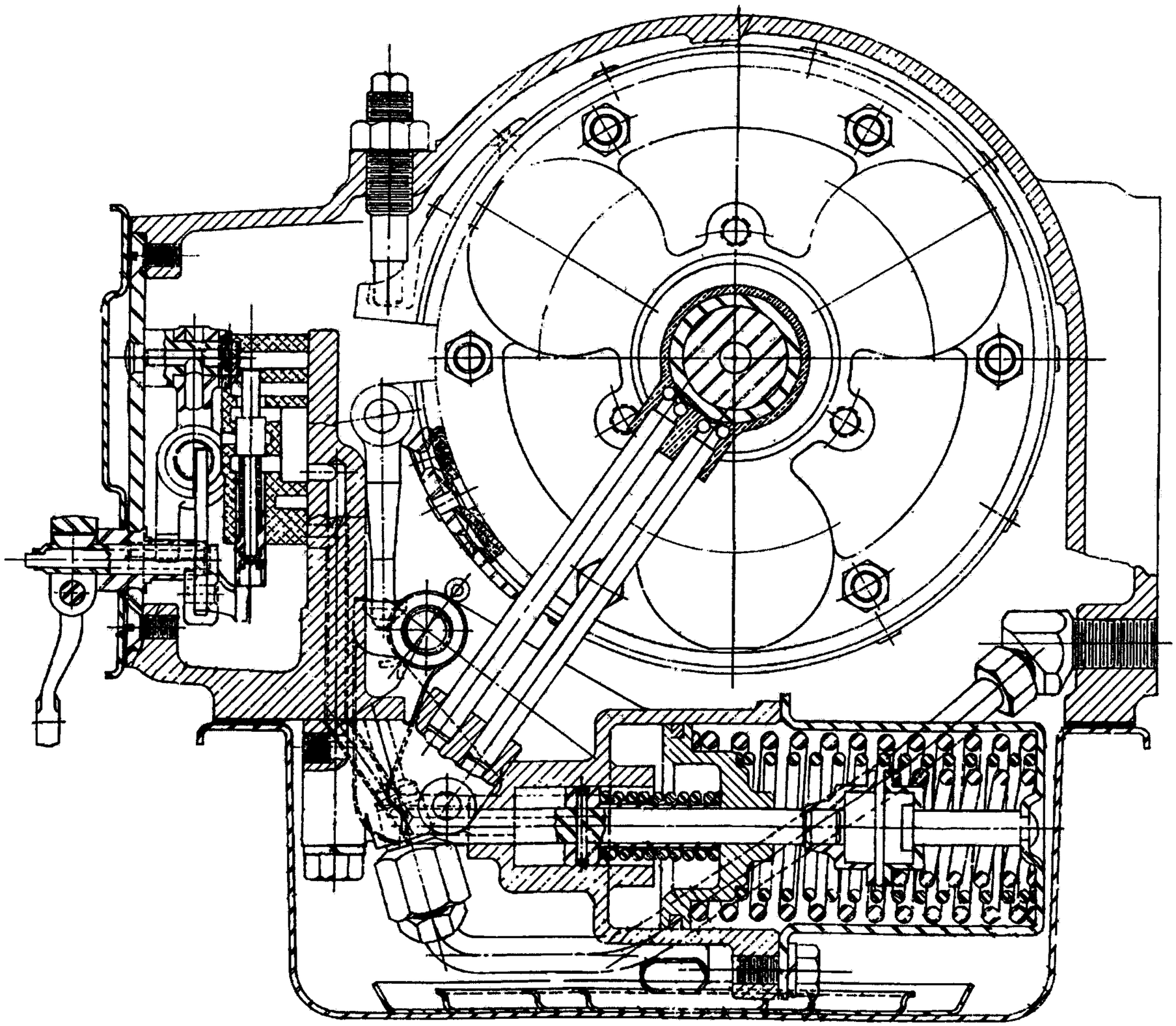
Do not use sealing compounds or shellac on any of the gaskets (except transmission to flywheel housing gasket).

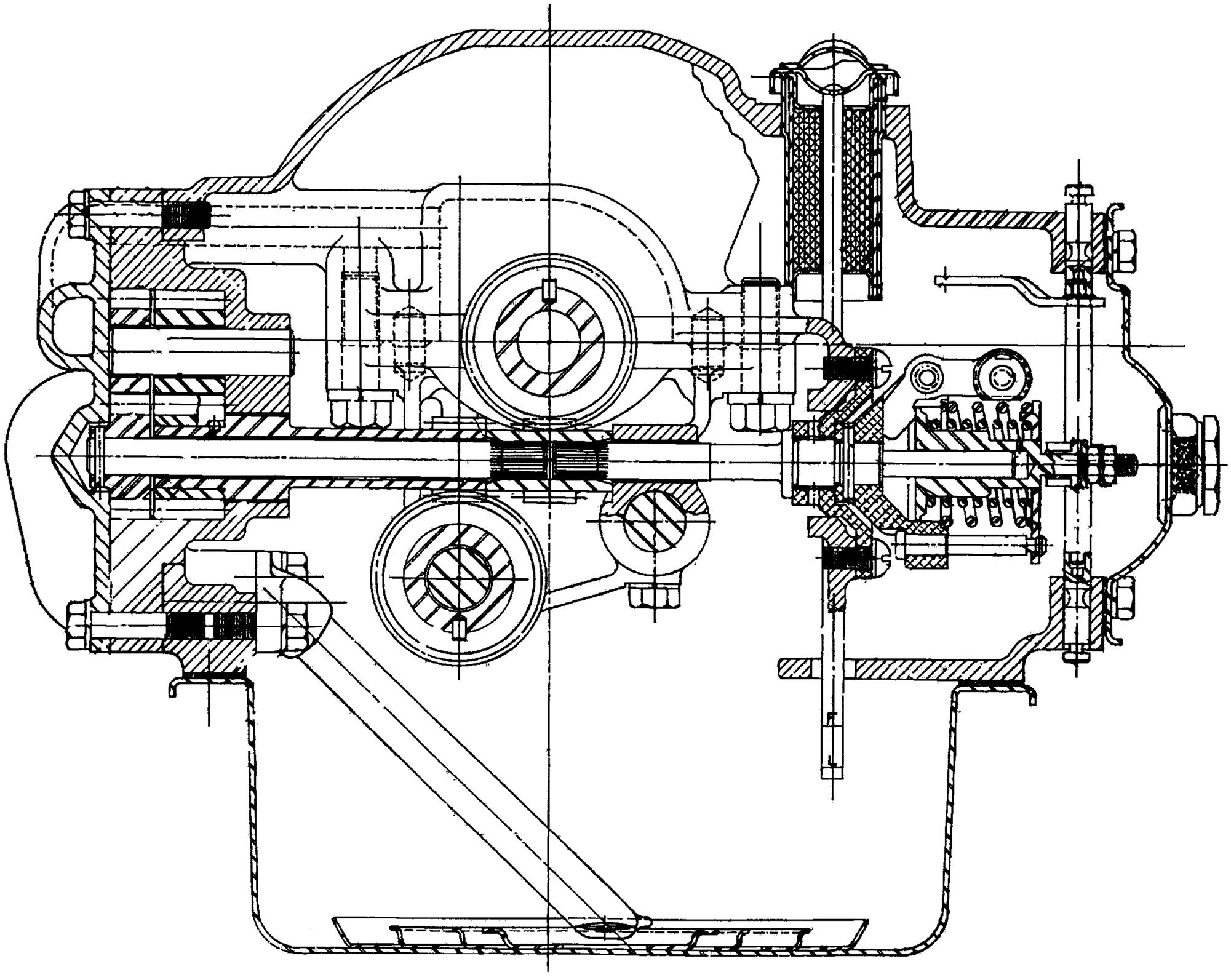
To install detent ball between shifter fork and rail, it will be convenient to use Tool J-1147. This is simply a short pointed piece of stock used for holding detent ball in place in fork. The tool is forced out when the shaft is entered. It is possible to install the shaft so the notch will not match with the detent ball. Care should be exercised to see that these line up when assembling.

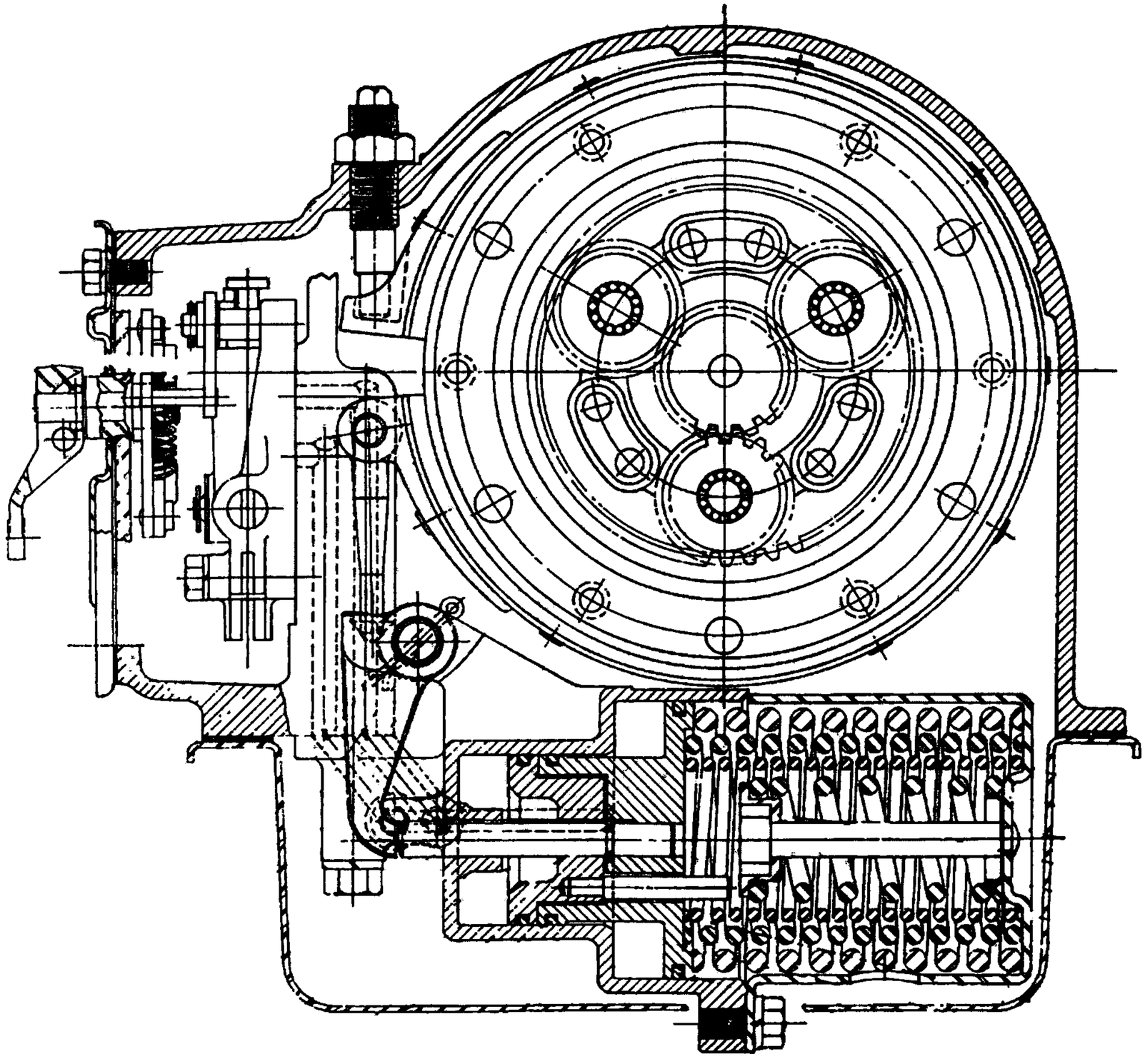
MEMORANDA











SELF SHIFTING TRANSMISSION

RATIO CHANGE SPEEDS

SPEEDS AT WHICH SHIFTING OCCURS WITH OIL AT NORMAL HEAT.
VARIATIONS IN ENGINES, SETTINGS, OIL VISCOSITY, SPEEDOMETER, ETC. MAY VARY THE SPEEDS SHOWN IN THE FOLLOWING CHART.

UP SHIFT				DOWN SHIFT			
THROTTLE PARTLY OPEN	M.P.H.	THROTTLE WIDE OPEN		THROTTLE PARTLY OPEN	M.P.H.	THROTTLE WIDE OPEN	
10 TO 12		20 TO 24	1ST TO 2ND				2ND TO 1ST
				6 TO 8		10 TO 12	
7 TO 9		7 TO 9	1ST TO 3RD				3RD TO 1ST
				0 TO 3		0 TO 3	
20 TO 24		60 TO 70	3RD TO 4TH				4TH TO 3RD
				15 TO 17		22 TO 60	
MOVE CONTROL LEVER BELOW 15		BELOW 40	2ND TO 3RD				3RD TO 2ND
				MOVE CONTROL LEVER ★			
MOVE CONTROL LEVER ABOVE 15		WILL NOT OCCUR	2ND TO 4TH				4TH TO 2ND
				MOVE CONTROL LEVER ★			

★ LOCKED OUT ABOVE 57 M.P.H.
NOT ADVISABLE (WITHOUT DECLUTCHING)
ABOVE 25-30 M.P.H.

ANALYSIS OF SHIFTING WITH PROPER OIL AT NORMAL LEVEL AND OPERATING TEMPERATURE

UP SHIFTS

1st to 2nd

Control lever in low range.

This is a governor controlled valve shift.

When engine speed reaches approximately 1300 R.P.M. (10 M.P.H.) minimum throttle, governor expands sufficiently to trip the governor controlled valve, and oil is directed to the front planetary unit, releasing servo band and engaging clutch.

If full throttle is used, the accelerator position shifts governor linkage fulcrum and will delay tripping of governor controlled valve until approximately 2500 engine R.P.M. is reached (22 M.P.H.).

1st to 3rd

Control lever in high range.

This is an oil pump pressure regulator valve shift.

At approximately 925 engine R.P.M. (8 M.P.H.) the oil pump will have sufficient capacity to cause the pressure regulator valve to lift and oil is directed by manual controlled valve to the rear planetary unit releasing servo band and engaging clutch.

This shift cannot be affected by throttle position.

DOWN SHIFTS

2nd to 1st

Control lever in low range.

This is a governor controlled valve shift.

When engine speed drops to approximately 700 R.P.M. (7 M.P.H.) the governor contracts and trips governor controlled valve, causing oil to be cut off from front planetary unit. Servo band engages and clutch releases.

If full throttle is used, with car decelerating, as on a steep grade or pulling through deep sand, etc., the fulcrum point of the governor linkage shifts and causes the governor to trip governor controlled valve sooner or at an engine speed of approximately 1100 R.P.M. (11 M.P.H.).

3rd to 1st

Control lever in high range.

This is an oil pump pressure regulator valve shift.

With car decelerating at an engine speed of approximately 200 R.P.M. (3 M.P.H.) the oil pump pressure regulator valve drops, cutting off oil to both planetary units. Servo bands engage and clutches are released.

NOTE: Excessive leakage in oil pump assembly, or regulator valve, or an improper regulator valve spring, will cause shift at a higher speed. When this occurs at a speed where governor opens governor controlled valve, "hunting" will occur between 1st and 2nd.

UP SHIFTS

3rd to 4th

Control lever in high range.

This is a governor controlled valve shift.

When engine speed reaches approximately 1350 R.P.M. (22 M.P.H.) with minimum throttle, governor expands sufficiently to trip the governor controlled valve and oil is directed to the front planetary unit, releasing servo band and engaging clutch.

If full throttle is used, the accelerator position shifts governor linkage fulcrum and will delay tripping of governor controlled valve until approximately 3750 engine R.P.M. (63 M.P.H.) is reached.

2nd to 3rd

Shift control lever from low to high range.

This is a manual controlled valve shift.

It will occur on part throttle, if manual shift is made below 15 M.P.H. or at any time this manual shift is made under full throttle conditions up to approximately 63 M.P.H.

DOWN SHIFTS

4th to 3rd

Control lever in high range.

This is a governor controlled valve shift.

Governor contracts and trips governor controlled valve at approximately 700 engine R.P.M. (16 M.P.H.) with minimum throttle.

If accelerator is opened to full throttle, this shift will occur up to approximately 2500 engine R.P.M. (58 M.P.H.).

3rd to 2nd

Shift control lever from high range to low range.

This is a manual controlled valve shift.

Moving the manual controlled valve cuts off oil from the rear planetary unit and causes band to engage and clutch to release.

At approximately 2400 engine R.P.M. (55 M.P.H.) the manual controlled valve is locked by a "lock out" lever attached to governor linkage and valve will not move even though hand control lever is shifted. Therefore, shift cannot occur until speed drops to this point.

UP SHIFTS

2nd to 4th

Shift control lever from low to high range.

This is a manual controlled valve shift.

Manual controlled valve directs oil to the rear planetary, releasing band and engaging clutch.

(Front servo band is already released and clutch engaged.)

NOTE: Under full throttle conditions, the governor controlled valve will cause shift to 3rd.

DOWN SHIFTS

4th to 2nd

Shift control lever from high to low range.

This is a manual controlled valve shift.

Moving the manual controlled valve cuts off oil from the rear planetary unit and causes band to engage and clutch to release.

At approximately 2400 engine R.P.M. (55 M.P.H.) the manual controlled valve is locked by a "lock out" lever attached to governor linkage and valve will not move even though hand control lever is shifted. Therefore, shift cannot occur until speed drops to this point.

LITHO IN U. S. A.